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LEPTOSPIROSIS

Part I

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Part II—Clinical Aspects of Leptospirosis

By

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(FINCHLEY, N.3)

The recognised importance of the subject of leptospirosis from the public health aspect, and the interest aroused by the circulated paper by Miss Joshua and Dr. Broom, attracted a good attendance for this session at the Hoare Memorial Hall on the morning of Saturday, August 13th, despite the holding of a simultaneous discussion, also at Church House, Westminster. The President's reception on the previous evening threatened a late start, but the Chairman, Mr. S. F. J. HODGMAN, M.R.C.V.S., handled the situation firmly. Having introduced the essayists (Miss Joshua as a well-known London practitioner and as the President of the Central Veterinary Society, and Dr. Broom as a distinguished Wellcome research bacteriologist) and ascertained that they did not wish to enlarge on their paper prior to its discussion, he promptly called on the first opener, Professor A. J. Brion, of the Lyons Veterinary School, whose contribution, however, was read on his behalf by his French colleague, Professor E. F. Lucam.

The joint paper by Miss Joshua and Dr. Broom was as follows :—

Leptospirosis *

PART I

(By J. C. BROOM)

Introduction

The disease of man and animals now known to be caused by infection with *Leptospira* was first recognised as a clinical entity in human medicine. The name " Weil's disease " was suggested by Goldschmidt (1887) from the four cases of febrile jaundice with relapse described by Weil (1886). The name has persisted, though there is no doubt that Landouzy (1883*a* and *b*) had given a very accurate picture of the disease three years earlier than the eponym. Dupré (1891) claims that a number of other French writers also recognised the condition still earlier, but the clinical details are not sufficiently complete, in our opinion, to enable a definite decision to be reached. Landouzy, and also Ducamp (1890) both comment on the association of the disease with sewers, but in their view the important factor was not rats, but " noxious exhalations." Sézary (1890) noticed that a relatively high proportion of his patients were slaughterhouse workers. He suggested that Weil's disease might be primarily an infection of animals which could be transmitted to man, though it was cattle he had in mind as the non-human host.

The causal organism of Weil's disease was isolated from man in Japan by Inada and his colleagues, and was named *Spirochaeta icterohaemorrhagiae*. The first report in English appeared in 1916, though these observers had previously published their findings in Japanese. Rats, especially the brown rat *Rattus norvegicus*, were shown by Inada *et al.* (1917) to be carriers of the spirochaetes, which were shed in the urine. Attention was directed to this animal because of the number of cooks affected, and the rat-ridden state of their kitchens. In Germany, Uhlenhuth & Fromme (1916) independently isolated the organism from cases of Weil's disease occurring in front-line troops, and they named it *Spirochaeta icterogenes*. The German and Japanese strains were shown to be identical by Noguchi (1917), and he established a new genus *Leptospira* with the type species *Leptospira icterohaemorrhagiae*.

The Japanese workers called the disease " spirochaetosis icterohaemorrhagica " and the equivalent leptospirosis icterohaemorrhagica is still used. The term, however, is clumsy, and others such as " leptospiral jaundice " or " infective jaundice " are often employed, but are inappropriate because jaundice is not an essential feature of the disease. In recent years, therefore, there has been a tendency to revert to " Weil's disease " as being the least undesirable term.

Other leptospirae have been isolated from a variety of disease conditions in man and other animals. Many of these strains are distinct antigenic entities, and have constant clinical and epidemiological characteristics. Collier (1948*a*) and most workers refer to them as separate species, but some observers consider this unjustified, though few go so far as van Riel (1948) who holds that leptospirae consist of an antigenic mosaic which defies accurate classification. Without joining in this taxonomic controversy one may say that there are undoubted practical advantages to be gained by distinguishing different strains on antigenic, clinical and epidemiological grounds. We shall therefore refer to them throughout as separate species.

Leptospirosis in Animals

DOGS.—The possibility of the infection of dogs with *L. icterohaemorrhagiae* was recognised as early as 1916 by Krumbein & Frieling, and the records of a number of

* Presented to the Sixty-seventh Annual General Meeting and Congress of the National Veterinary Medical Association, in London, on August 13th, 1949.

proved and probable instances have been reviewed by Stuart (1946). The importance of the epizootic form in dogs was established by Okell, Dalling & Pugh (1925) who showed that "yellows" was caused by this organism, and that the strains isolated from dogs and rats are serologically identical. Two clinical forms of leptospirosis were recognised by Klarenbeek (1927), an icteric form, and a second in which symptoms of nephritis predominated. Leptospirae were seen in sections of kidney in both conditions, but it was not till 1933 that Klarenbeek & Schüffner isolated the second species from dogs and named it *L. canicola*. Unlike other leptospirae, this species apparently has no rodent carrier host, and the organism is transmitted directly from dog to dog by means of infected urine. Surveys of healthy dogs show that a high proportion present serological evidence of past infection. In addition to acute infections, many cases occur without clinical symptoms of illness. However, it can be shown by histological examination that the leptospirae produce localised areas of interstitial nephritis, and may thus be one of the causes of chronic nephritis which is so common in older dogs.

CATS.—Esseveld & Collier (1938) found that cats in the Dutch East-Indies are frequently infected with *L. bataviae*, and occasionally with *L. javanica* and *L. semarang*. The position as regards *L. icterohaemorrhagiae* is still unsettled. Wirth (1937) believed that he observed one spontaneous infection, and van den Brekel (1938) considered, on rather slender evidence, that cats were the source of infection in two human cases of Weil's disease. Petersen (1949) stated that Ottosen obtained a positive serological reaction in one cat. On the other hand, Schmidt (1936) found completely negative results in a survey of 40 cats. We have tested serum from a small number of urban cats, destroyed for various reasons, against *L. icterohaemorrhagiae*, *L. canicola*, *L. pomona*, *L. grippotyphosa*, *L. sejroe* and *L. bataviae*. Agglutinins in low titre for *L. icterohaemorrhagiae* have been found in two, but otherwise the reactions have been consistently negative.

PIGS.—Infections of pigs with *L. icterohaemorrhagiae* have been recorded by Sander (1935), Klarenbeek & Winsser (1937), Hougardy (1938) and Collier (1948*b*). In the same communication Collier records the isolation from pigs in the Dutch East Indies of *L. pomona*, *L. akiyami*, *L. bataviae*, *L. pyrogenes*, *L. australis*. The leptospira most commonly found in pigs is *L. pomona*. In young animals it produces some fever and conjunctivitis, but the illness is not serious. The infection, however, is often transmitted to swineherds, as was first proved by Gsell (1944), who showed that the organism was the same as that isolated in Queensland by Johnson (1938). Another serological type, *L. mitis*, was found in pigs at Brisbane by Johnson (1942). Leptospirae have been isolated from pigs and man in the Argentine by Savino & Rennella (1944; 1946), and named by them *L. suis*. The evidence that these strains differ from other known species is, however, not yet fully established.

CATTLE.—Noguchi (1922) described a leptospira present in the gastric mucosa of an ox, but it was apparently non-pathogenic. Minchin & Azinov (1935) isolated a strain from a fatal case of icterohaemoglobinuria in a calf in the Caucasus, and named it *Spirochaeta haemoglobinuriae vitulorum*. The same organism was found by Drozdov (1942). Another strain, *L. vitulina*, was obtained from jaundiced calves and human cases by Terskikh (1940) but he provides no serological comparison with known types. *L. mitis* (Johnson, 1942) occurs also in cattle. Leptospirae were seen by Jungherr (1944) in the kidney, liver and mesenteric glands of three cows which died in Connecticut. No strain was isolated but Jungherr considered the organisms to be the cause of the disease. Similar observations, also in the U.S.A., were made by Marsh (1945) and Mathews (1946), both of whom demonstrated leptospirae in sections of liver tissue obtained at necropsy. Sutherland & Morrill (1948) infected guinea-pigs from an acute fatal case of leptospirosis in a cow in Illinois, but were unable to culture and identify the organism. The disease was characterised by jaundice, anaemia and haemoglobinuria. Histological changes included centrilobular necrosis throughout the liver, and early focal interstitial nephritis.

Bernkopf and his colleagues have made an intensive study of strains of leptospirae isolated from cases of jaundice in cattle in Palestine and named *L. bovis* (Bernkopf, 1946; 1948: Bernkopf & Olitzki, 1948: Bernkopf, Olitzki & Stuczynski, 1947: Freund, 1947: Ungar & Bernkopf, 1947).

In very acute cases of the disease the onset is sudden, with fever. The urine is very dark in colour, and the mucous membranes are deeply jaundiced. Albumin and haemoglobin are present in the urine in large amounts, and death ensues in three to seven days. In the more common form, a pink discoloration of the milk is first noted. The volume of milk decreases, jaundice appears and there are symptoms of digestive disturbance. These signs disappear after about two weeks, but convalescence is slow. The histological appearances resemble those in Sutherland & Morrill's cases.

This species is related serologically to *L. grippotyphosa*, which Nickolojiv (1946) found to be a cause of epizootics among cattle in Russia. Bernkopf & Olitzki (1948) showed that the two species each contain two antigens which they designate "B" and "G". In the Palestine strains, "B" is the major and "G" the minor antigen, whereas the reverse is the case in *L. grippotyphosa*. It should be noted that the letter "B" has long been in use to describe one of the antigens of *L. icterohaemorrhagiae*; unless some other letter is attached to the major antigen of *L. bovis* considerable confusion will arise in the literature.

The Palestine strain has been proved by Bernkopf & Little (1948) to differ from the New Jersey strain isolated by Baker & Little (1948) from cattle during an outbreak of bovine mastitis. The milk of affected cows had a bloody or thickened yellowish appearance. The animals showed fever, rarely haemoglobinuria and lowered milk yield. In calves infected experimentally and sacrificed after various time intervals, the main pathological change was interstitial nephritis.

The isolation of a strain of *L. icterohaemorrhagiae* from a fatal case of jaundice in a calf in England has recently been reported by Field (1949), and we found agglutinins to the same organism in the serum of a jaundiced calf which was under the care of Mr. Bruford, Sevenoaks, Kent.

HORSES.—Heuser *et al.* (1948) consider that "moon-blindness" or periodic ophthalmia may be the result of leptospiral infection. This conclusion was reached from the results of agglutination tests only, because no cases were seen sufficiently early to allow the isolation of strains from the blood. During the acute exacerbations, the agglutinin titre of the aqueous humour of the eye was higher than that of the blood. Of 344 horses which gave positive serological reactions, 256 (75 per cent.) agglutinated with *L. grippotyphosa*; 49 (15 per cent.) with *L. pomona*; 33 (9 per cent.) with *L. australis*; and the remainder with *L. icterohaemorrhagiae* or *L. sejroe*. In a survey of 291 healthy horses, positive agglutinations were obtained with the sera of 123 (40 per cent.), but the suggestion is made that these animals may have suffered from infections which produced no eye lesions. The evidence is far from conclusive, but the hypothesis is interesting in view of the frequency of eye lesions in man in the meningeal form of Weil's disease which has been commented on by Buzzard & Wylie (1947).

Sheep and Goats.—Wirth (1937) states that goats can be infected with *L. icterohaemorrhagiae*, and Freund (1947) observed that *L. bovis* is pathogenic for both sheep and goats. There are, however, apparently no reports of spontaneous cases of the disease in these animals.

Foxes.—Dunkin & Laidlaw (1925) found a sick, jaundiced wild fox, from which they isolated *L. icterohaemorrhagiae*. An outbreak of jaundice among silver foxes was investigated by Catchpole (1934). The organism was not isolated but was most probably *L. icterohaemorrhagiae*.

Ferrets.—A human case of Weil's disease is recorded by Brown & Cleveland (1932) in which the source of infection was evidently a ferret which later died with jaundice.

Apes.—Strains of leptospirae were isolated by Wilbert (1927) from fatal cases of jaundice among chimpanzees in West Africa. The strain was tentatively named *Spirochaeta anthropopitheci* by Wilbert & Delorme (1927), but the same workers (1928) proved it to be identical with *L. icterohaemorrhagiae*.

Carrier Hosts

With the exception of *L. canicola* which, as noted above, affects only dog and man, each species of leptospira has its rodent carriers. A single species of leptospira may be carried by different species, or even genera, of Muridae, and similarly a single rodent species may be able to act as host to different species of leptospirae. As a general rule, however, each leptospira has its own characteristic carrier, a matter of considerable importance in epidemiology. For details of hosts and parasites, reference should be made to van Thiel (1948) or Collier (1948*a*).

Personal Observations

Our experience of leptospirosis in animals has been almost entirely limited to dogs, and the clinical aspects of the disease will be considered in a later section. It may also be useful to analyse the records of agglutination tests carried out for diagnostic purposes from March, 1947, to May, 1949, inclusive, on specimens of blood from 519 dogs.* For comparison we have the results of tests on 121 dogs which were not suffering from acute leptospirosis when the examinations were made.

The technique of the modification of the agglutination test we use has already been described by Broom (1948). Briefly, it consists in incubating together a formalinised culture of leptospirae and varying dilutions of the serum, for 18 hours at 5°C. Drops of the mixtures are then examined microscopically, by dark-field illumination, and the titre of the serum is taken as the highest dilution in which approximately one-half of the leptospirae are agglutinated in clumps, and the remainder appear unaffected. Lesser degrees of agglutination are disregarded. This purely arbitrary standard has been adopted on the grounds of simplicity, but it leads to the titres recorded being lower than those of observers who take the end point at the last dilution which shows any trace of agglutination. In the same way, formalinised cultures offer practical advantages in our opinion over living suspensions, though a serum will usually agglutinate or lyse the latter to a higher titre. It is not possible therefore to compare the antibody levels reported by different workers unless the techniques are identical.

As was also shown by Broom (1948), the maximum titre developed varies greatly in different individuals. It is difficult therefore to set a level to which the titre must rise before it is considered diagnostic of present infection. Increasing titres in successive specimens of blood taken at intervals of a few days provide a much more valuable indication.

It is usual, especially in the early stages of the illness, for the serum of a dog infected with one species of *Leptospira* to show some degree of para-agglutination with the heterologous species. As a rule, the homologous titre is much higher, allowing the differentiation to be made easily. On occasion, however, the two titres are approximately equal. Further tests in these cases will generally indicate the infecting species, because the homologous titre rises during the course of the illness whereas the heterologous titre falls. Alternatively, the species can be determined by cross-absorption tests, provided the original titres were 1 : 1,000 or higher. With lower antibody levels the results are not satisfactory.

Analysis of Results

In Table I are set forth the details of the infections found among the dogs examined for diagnostic purposes (Diagnosis Series) and also the Survey Series. In both groups the cases of canicola fever outnumbered those of yellows, as is the usual finding, the ratios being 8·5 : 1 and 3·3 : 1 respectively. The area from which most of the survey group came had also a high incidence of acute *L. icterohaemorrhagiae* infections, and this may explain the difference in the ratios between the two series.

Table I

	Diagnosis Series	Survey Series
Total number tested	519	121
Total number infected	305	45
Proportion infected	*	38%
Number due to *L. canicola*	251	33
Number due to *L. icterohaemorrhagiae* ...	30	10
Number not differentiated	24	2
Ratio *L. canicola*/*L. icterohaemorrhagiae* ...	8·5 : 1	3·3 : 1

Showing the infecting organism in infected dogs.
* Not applicable.

Seasonal Incidence.—The average number of acute cases occurring in each month is shown in Fig. 1. The period covered by these observations is just over two years, so only a tentative conclusion may be drawn. It appears that the incidence is highest in January and February, falls during

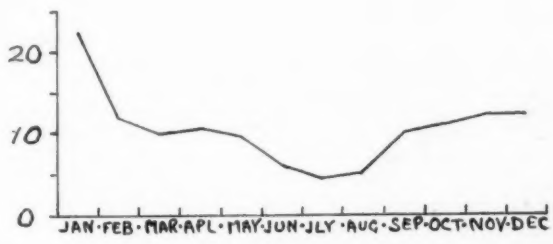

Fig. 1.—Showing Seasonal Variation of Incidence of Acute Leptospirosis

* We should like to express our thanks to the many practitioners who have supplied us with details about the animals tested.

the middle of the year, and rises again towards the end. This may be associated with the fact that leptospirae shed in urine are less likely to be desiccated and die during the wetter months.

Sex.—The sex was known for 407 animals in the Diagnosis, and for all the Survey Series. The distributions are set out in Table II and show an interesting disparity between the two groups. Acute leptospirosis was suspected in four and a half times as many dogs as bitches, and the diagnosis was confirmed serologically six and a half times as often. This may reflect the preponderance of males in the dog population, and the greater risk of infection resulting from their habits. The Survey figures, however, are a record of recovered, or inapparent, infections, and here the proportion of males to females is much lower. May this indicate a difference in recovery rate between the sexes, or is the general expectation of life lower for male dogs at all ages?

Table II

	Diagnosis series		Survey Series	
	Total Examined	Number Positive	Total Examined	Number Positive
Males	333	193	73	27
Females	73	29	48	10
Ratio M/F ...	4·5 : 1	6·5 : 1	1·5 : 1	2·7 : 1

Showing sex distribution of infections.

Age.—The distribution by age, known for 228 cases in the Diagnosis Series, is shown in Table III. It will be seen that two-thirds of the cases occur under four years of age, and that the risk of infection diminishes with age, though cases continue to appear among the higher age groups. The oldest dog in this series was 13 years of age.

Table III

Age in years	<1	1–	2–	3–	4–7	>7
Number of cases	30	48	51	23	49	27

Showing the age distribution of 228 acute infections.

Breed.—Broom & MacIntyre (1948) found no difference in the infection rate among different breeds in their survey, but they pointed out that their series contained none of the smaller dogs. In the present investigation no selection of material was made, so the results probably give a truer picture. The greatest number of infections occurred among mongrels (76); very many of these animals were treated at the Royal Veterinary College, London, which is situated in an area where that "breed" abounds, and where hygienic conditions are poor. In descending frequency, the order of the commoner breeds was: spaniel (44), Scottish terrier (28), fox terrier (24), Alsatian (21), collie (10). Over 30 breeds were represented in the total, but the numbers of the others are too small to be of value. The question of the relationship of breed to chance of infection will be considered later.

PART II

CLINICAL ASPECTS OF LEPTOSPIROSIS

(By Joan O. Joshua)

Introduction

Leptospirosis, other than the acute disease caused by *Leptospira icterohaemorrhagiae*, in animals and man, has been recognised on the continent of Europe as causing widespread disease in many species, particularly dogs and man.

In this country, until 1947, leptospiral infections have been the subject of very little interest in either medical or veterinary science apart from Weil's disease in man and acute leptospiral jaundice or "yellows" in dogs. In 1946 Stuart stimulated interest in the incidence of *L. canicola* infection in dogs by his findings on serological examination of blood from street dogs in Glasgow. By 1947 practitioners in and near the London area were recognising cases of canicola infection as a clinical entity and since that time knowledge of the disease in this country has progressed rapidly. Up to the time of writing leptospirosis has been recognised primarily as a disease of dogs and man in this country; two cases have been recorded in calves, but in horses, pigs and cats the disease has not so far been reported.

The recognition of leptospirosis as a not uncommon disease of dogs is of considerable importance to the small-animal practitioner since there can be little doubt that a high proportion of the cases of acute and sub-acute nephritis occurring in young dogs is due to invasion by this organism. Furthermore, evidence is accumulating that leptospirae may play a considerable aetiological role in the chronic nephritis of the old dog; it seems equally probable that residual infection of the kidneys may persist for quite long periods, even after apparent clinical recovery, and may account for the recurring attacks of sub-acute nephritis not infrequently encountered in dogs at and above middle age.

The finding of positive reactions to *L. icterohaemorrhagiae* in the cat population will stimulate interest in the occurrence of leptospiral infection in this species although cases of clinical disease are as yet unrecognised.

Incidence

The incidence of leptospirosis among farm animals in this country is unknown and remains to be investigated. In dogs, however, the picture is becoming reasonably clear although much further investigation is needed to reflect the incidence in different areas. Broadly speaking, between 40 and 50% of dogs living in urban areas show agglutinins to one or other type of leptospira. In view of the generally accepted specificity of the agglutination test, the presence of agglutinins, even in low titre, shows that the dog has, at some time in its life, been infected with the organism, but does not necessarily indicate that clinical disease has occurred. In all cases where a series of dog sera has been investigated the number reacting to *L. canicola* is considerably greater than those agglutinating *L. icterohaemorrhagiae*. The lowest ratio occurs in a series from the veterinary practice of one of us (J. O. J.), further details of which are discussed below. The ratio is approximately 4 : 1 but the series includes a number of cases of *L. icterohaemorrhagiae* infections which occurred during one particular season, and which in that year outnumbered the cases of leptospirosis due to *L. canicola*.

Analysis of the figures for the examination of sera from 100 unselected dogs in that series, from an average suburban district in North London, is of interest from a clinical point of view; the series naturally includes active cases of lepto-

spirosis. The ages of the dogs involved ranged from nine weeks to 16½ years; the series is reasonably representative of the breeds commonly encountered in ordinary practice.

Forty-three of the total 100 showed agglutinins to leptospirae; 31 had a higher titre to *L. canicola*, eight to *L. icterohaemorrhagiae*, and four showed agglutinins, in low titre only, equally to both organisms.

The occurrence of agglutinins in the various age groups is of considerable clinical interest.

DOGS

Under Six Months.—No puppy under six months old was a reactor, a finding which suggests very strongly that the acquisition of infection occurs in sexually mature dogs, a fact of some importance in considering the method and spread of infection.

Under One Year.—Three dogs under one year old were reactors; two of these, an Alsatian and a Welsh Collie type, were ten months old, all were males and all were clinical cases of leptospirosis.

Under Five Years.—There were 13 reactors in this group, eleven dogs and two bitches, of which only two were dogs not suspected of current or recent leptospiral infection.

Over Five Years.—There were 30 positives in this group of which only five were considered to show evidence of disease attributable to recent leptospiral infection.

Although a full clinical history of these older dogs was not obtainable in every case it will be appreciated that many of these were dogs which had been known in the practice for a number of years and which had never had any illness which could have been attributed to leptospirae. This suggests very strongly that a sub-clinical infection can occur in dogs, a factor of importance in considering both the spread of infection and the public health aspect.

From these figures it would appear that primary clinical disease is to be anticipated most commonly within an age range of ten months to five years.

Differential Sex Incidence.—Although there is some difference in the incidence of agglutinins in dogs and bitches this does not at present appear to be strikingly significant. Our series included 61 dogs and 39 bitches and the figures for the reactors were 29 dogs (approximately 50 per cent.) and 14 bitches (approximately 36 per cent.). The breed incidence of the positive bitches is, however, of interest; they comprise four Scottish terriers, two pekingese, two cocker spaniels, three mongrels, one wire-haired fox terrier, one collie and one Irish setter, there being a marked preponderance of relatively low-to-ground bitches carrying heavy feathering.

CATS

A series of bloods from unselected cats is being examined. To date 38 sera have been tested and three have shown agglutinins to *L. icterohaemorrhagiae*. In view of the contact between cats and rats and other rodents the markedly lower incidence of infection is perhaps surprising, particularly as cases of jaundice and nephritis in cats are not rare in practice. The explanation is probably to be found in the fastidiousness of cats in their sexual and excretory habits. It may be of significance that one of the reacting cats was considered to be showing clinical evidence of chronic nephritis at the time of destruction. The importance of the identification of even a small percentage of reactors in the cat population can scarcely be over-estimated from the public health viewpoint, indicating as it does another possible source of human infection.

Infection and Spread

Although difficult of proof, evidence seems to be mounting to suggest that infection occurs mainly *via* the urino-genital tract, occasionally by penetration of the intact skin (particularly the very thin skin of the interdigital fossa in dogs) and only rarely by the ingestion of infected water or food. Direct dog to dog transmission, other than by coitus, seems improbable.

Although evidence of a persisting leptospiruria beyond six months is not available, the existence of apparently healthy dogs showing agglutinins to leptospirae in fairly high titre postulates a carrier state which may persist for long periods; such dogs shed leptospirae in their urine, thus contaminating ponds, brooks and damp areas of ground. The duration of viability of *L. canicola* outside the animal body is not known, but on grounds of clinical observation it seems probable that suitable environments may remain infective for considerable periods of time. Many clinicians recognise a curious area incidence of cases of leptospirosis, and can often trace many cases to a common source of potential infection, *viz.*, a stagnant pond or marshy ground. While not occurring in epidemics, small outbreaks of sporadic cases of leptospirosis often arise within a well-defined area in such a way that it is impossible to regard their occurrence as purely coincidental.

The evidence for the belief that leptospirosis arises primarily as an infection of the urinary tract is as follows:—

1. The fact that leptospirosis appears to occur in dogs over the age of puberty only [this does not, of course, include kennel outbreaks of acute *L. icterohaemorrhagiae* infection as described by Okell, Dalling & Pugh (1925), and the infection of her litter by a bitch as described by Roos *et al.* (1937)]. After sexual maturity in the dog the stance for urination changes, and the characteristic posture adopted by the male dog allows the hair surrounding the prepuce to come into actual contact with walls, lamp-posts, etc., against which other dogs have previously urinated; in the case of the bitch, breeds with heavy feathering come into contact with infected material in the same way, hence the significance in the breed incidence already noted. In addition, the habit of sniffing at, or even licking, the external genitalia of their fellows, may allow mechanical transference of the organism from one dog to another.

2. In many cases of leptospirosis a history of immersion, partial or complete, in ponds or stagnant water, is often obtainable, again affording contact between the external genitalia and infected material. In this connection it is noteworthy that cases of leptospirosis rarely arise in dogs which are known to drink from, but not to enter, ponds from which other dogs have acquired infection following immersion.

3. The purely renal character of many cases of sub-acute leptospirosis. We find it difficult to accept the hypothesis put forward by Stuart & McIntyre that a primary invasive stage always occurs. Sub-acute leptospirosis is the commonest form met in our practice area and we are convinced that the nephritic symptoms associated with this type are indeed the primary illness. It is therefore not impossible to postulate an ascending infection *via* the urinary tract in some cases, at least.

4. The breed incidence. For many years veterinary surgeons have recognised a particularly high incidence of acute and sub-acute nephritis in the Scottish terrier; since recognising leptospirosis we have been able to incriminate the organism in all such cases. Whilst dogs of all types can be infected there seems to be some bias in favour of the short-legged, heavily feathered breeds and types of mongrel, suggesting that the hair around the external genitalia in both sexes may literally "pick up" the infection.

The ability of leptospirae to penetrate the intact skin is well recognised, but the dermis of the dog, in our opinion, affords

a relatively impenetrable barrier, with the exception of the interdigital fossa where the skin is extremely thin and easy of penetration. This may well be a route of infection in a proportion of cases, the organism again being acquired from infected water or damp and dog-fouled ground.

The ability of leptospirae to exist in an infective condition in suitable environments outside the animal body is borne out by the fact that some clinicians have noted a fairly well-defined seasonal incidence of leptospirosis from October to April inclusive, *i.e.*, the wetter periods of the year. It is noteworthy that during the abnormally dry autumn and winter of 1948–49 the incidence of cases of leptospirosis has been exceptionally low.

Character of the Disease in Dogs

With the exception of acute *L. icterohaemorrhagiae* infection, the symptomatology of which is well recognised and has been adequately described, leptospirosis gives rise to a predominantly renal syndrome.

L. canicola infection produces a syndrome varying from hyper-acute nephritis with rapid death from uraemia (the syndrome known to some clinicians as Stuttgart disease), through the various stages of acute and sub-acute nephritis to a nebulous malaise characterised by little more than depression and occasional vomiting. Icterus is rare in leptospirosis canicolaris but has been noted; in our experience one case showing icterus occurred in which there was considerable and wide-spread tissue damage involving many organs. The usual features of nephritis are present in most cases, *viz*: vomiting, depression, loss of condition, "tucked-up" appearance, pain in the renal area, increased or decreased thirst with corresponding polyuria or oliguria, uraemic odour from the mouth (usually slight); variable or lost appetite. In acute cases the temperature may be slightly elevated in the early stages, but more commonly is normal or sub-normal. Pulse may be bounding or thready—an exaggerated degree of aortic pulsation may be noted; heart action is usually somewhat toxic in character. Engorgement of the episcleral blood vessels may be noted, but is not regular. An enlarged left kidney (occasionally both) may be palpable. Changes in the tongue and buccal mucosa are an almost constant feature and in our view very significant from a diagnostic standpoint. In acute cases the usual ulceration of the buccal mucosa adjacent to the carnassial and canine teeth is present, possibly with necrosis and/or sloughing of the tongue-tip. In sub-acute cases the tongue appears dry and is changed in colour to a dirty brick red or brown; this may involve the whole dorsum or merely the part towards the tip. Brown staining of the teeth may occur but is quite distinct from the accumulation of brown slime found in so-called "brown mouth disease."

In very mild cases there may be an almost complete absence of characteristic symptoms, and diagnosis may be difficult. Such cases usually show some depression, slight loss of appetite and occasional vomiting. Failure of such cases to respond to symptomatic treatment should arouse suspicion of leptospirosis.

Sub-acute *L. icterohaemorrhagiae* infection gives rise to a similar train of symptoms to that in sub-acute canicola fever. Slight icterus may be observed after four to six days; in addition, the dog usually seems more severely ill than the corresponding case of *L. canicola* infection in spite of the absence of serious symptoms. Failure or delay in response to penicillin therapy may be a pointer to *L. icterohaemorrhagiae* being the organism involved. The existence of this purely renal form of *L. icterohaemorrhagiae* infection is of the utmost importance to small-animal practitioners, both on diagnostic and public health grounds, since it has previously been the custom to suspect infection with this organism only in cases showing the well-known and characteristic symptoms of acute leptospiral jaundice. Curiously, although the organism is present in the bladder and is excreted in the urine, symptoms indicative of cystitis have not been observed, neither have the meningeal symptoms, so common in human leptospirosis, been recorded.

Prognosis

In primary, uncomplicated cases of *L. canicola* infection the prognosis is good if penicillin is exhibited early.

In *L. icterohaemorrhagiae* cases prognosis must always be extremely guarded in spite of penicillin and serum therapy.

Diagnosis

It is proposed to consider methods of diagnosis from the angle of the average clinician engaged in small-animal practice.

A. On Clinical Grounds

The general picture of depression, vomiting, a tucked-up appearance, discolouration of the tongue, with or without obvious renal involvement, should arouse suspicion. Urine analysis is of little value, the only findings being an altered specific gravity, compatible with the increase or decrease in water intake, and an occasional slight albuminuria. In our experience heavy albumin loss is not associated with renal damage caused by leptospirosis.

Differential diagnosis must exclude the virus diseases (the absence of catarrhal symptoms in leptospirosis is helpful), obstruction of the alimentary tract by foreign bodies or neoplasm, and nephritis due to other causes.

B. Agglutination Test

Whenever possible clinical diagnosis should be confirmed by examination of a blood sample. Agglutinins are absent in the early stages of the disease, gradually rising to a maximum in three to four weeks from the onset. The ideal method is to take a blood sample as soon as leptospirosis is suspected, when agglutinins should be absent or present in only very low titre, and to take a repeat sample after ten days when the titre should show a marked rise; this rise in titre, combined with the clinical picture, is sufficient to establish the diagnosis. Repeated serum examination may be necessary in some cases to identify the organism involved since para-specific reactions are common.

C. Isolation and Recognition of the Organism

While this is undoubtedly the most scientific method, we find it difficult to accept the contention of Stuart & McIntyre that it is within the scope of everyday practice. The suggested method is by dark ground examination of blood in those cases in which a primary invasive stage is recognised, or of catheter samples of urine at the stage of primary renal disease in other cases.

Our reasons for doubting the practicability of this method for day-to-day diagnosis are: (1) the opinion expressed by many bacteriologists that the recognition of leptospirae is a matter of some expertness, (2) the relatively complicated technique of dark-ground illumination microscopy and (3) the objection of many clinicians, on surgical grounds, to the use of the catheter in the dog except in cases of extreme necessity. We, personally, should never be prepared to

catheterise for purposes of diagnosis. This latter objection may not be valid if it is possible to use urine collected in the usual way.

Treatment

It is not proposed to discuss symptomatic treatment which may be needed as an adjunct to specific therapeutic measures.

In mild cases of canicola infection exhibiting merely vague symptoms of malaise the use of penicillin may be helpful as response to this agent is both speedy and extremely definite.

In primary, uncomplicated cases of leptospirosis canicolaris penicillin gives extremely satisfactory results, the clinical improvement usually being spectacular. It is generally necessary to give a six- or seven-day course of penicillin, but in any case treatment should be continued for at least 48 hours after apparent clinical recovery. Emphasis is laid on the value of penicillin in *primary uncomplicated* cases of *L. canicola* infection, since some practitioners have been disappointed because of the failure of this agent in cases which eventually prove to be due to *L. icterohaemorrhagiae*, or are seen only at the secondary renal stage as described by Stuart & McIntyre.

The view expressed by Joshua & Freak in 1947, that some dogs were left with residual kidney damage after apparently complete clinical recovery following penicillin therapy has recently been strikingly borne out by the experimental work of Brunner & Meyer. These workers found that, in experimental infection of hamsters and dogs with *L. canicola*, penicillin cleared the leptospirae from the blood stream but not from the kidneys, where the organisms were still to be found in the convoluted tubules, and continued to be shed in the urine. They conclude, therefore, that while penicillin may save the life of an infected dog it may also favour the production of a carrier state. Streptomycin, on the other hand, administered over a three- to five-day period, caused complete disappearance of leptospirae from kidneys and urine; streptomycin was equally effective in a dog experimentally infected with *L. icterohaemorrhagiae*. From this work it would appear that streptomycin is unquestionably the agent of choice, but the practicability of its use at present in this country is extremely doubtful.

In cases which fail to respond to penicillin within 48 hours of the initiation of treatment and yet are considered to be cases of primary leptospirosis, anti-*Leptospira icterohaemorrhagiae* serum should be given in adequate doses. The response to serum treatment is variable, but good results are sufficiently frequent to warrant its use.

Prophylaxis

Serum.—The specific anti-*L. icterohaemorrhagiae* serum may be of value in protecting dogs in contact with acute cases of "yellows." The protection, of course, is short lived, and the method has no general application.

Vaccines.—Dalling & Okell (1926) employed a vaccine prepared from the livers of infected guinea-pigs in the prophylaxis of "yellows." A culture vaccine was introduced later and has been in use for a number of years, especially in kennels where a large number of animals is maintained.

Broom (1949*b*) and Brunner (1948) both found experimentally that culture vaccines of *L. canicola* protect hamsters against infection with that organism. No reports have been published of the effect of these vaccines in the prophylaxis of canicola fever in dogs. Until data have accumulated of the results of trials in the field, it is impossible to assess its value.

Aetiological Significance in Connection with Chronic Nephritis.—Infection with leptospirae unquestionably plays a large part in the production of renal damage leading to chronic nephritis in the old dog. Assessing evidence of nephritis on purely clinical grounds, our series of dogs so far shows that only 50 per cent. of those considered to be showing renal damage are reactors to either species of leptospira. This finding differs markedly from that of Stuart & McIntyre who found a very much higher percentage of reactors in dogs showing renal damage; these workers, however, were assessing renal function on an arbitrary blood urea level which undoubtedly accounts for the discrepancy. Considerable investigation will be necessary before the true aetiological significance of leptospirosis in canine nephritis can be assessed accurately.

Public Health Considerations

In view of the increasing number of cases of leptospirosis which are now being recognised in the human population this angle is of great importance, particularly as the dog is the only known host of *L. canicola*. It is from this point of view that the figures for the incidence of reactors in unselected series of dogs are so important, as indicating the prevalence of the organism rather than the incidence of clinical disease.

The recognition of positive reactors to *L. icterohaemorrhagiae* in the cat population is also of importance in this respect, particularly in connection with the uncastrated tom cat which urinates indiscriminately in houses and other places where people (particularly children) may acquire infection.

The veterinary surgeon's responsibility will be mainly in advising owners as to the possible risks of nursing and treating dogs suffering from leptospiral infections. An alarmist attitude in this connection seems unnecessary and undesirable, but it is clearly the duty of the clinician to point out that human infection is possible, particularly when the infecting organism is *L. icterohaemorrhagiae*. Since urine is the main infective agent it seems to us that it is sufficient to point this out to the owner or attendant, to recommend the wearing of rubber gloves if contact with urine is likely in the course of nursing, and to advise the adequate disinfection of sites contaminated with urine. Cases of concurrent illness in any family where an infected dog is or has been should call for close co-operation between the medical and veterinary practitioners in attendance.

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Discussion

Professor A. J. BRION (Ecole Nationale Vétérinaire, Lyons, France): Before entering upon the discussion of the extremely important report presented to this Congress by Miss Joshua and Dr. Broom, I wish to thank the President of the National Veterinary Medical Association for having, in good time, invited me to speak before my British colleagues so that I may be able rapidly to review the present state of the studies to which I have devoted myself in France, *viz.*, the canine leptospiroses, in order that they may be enabled to consider the subject from the viewpoints of our two countries.

To begin with, one fact must be stated: the very small importance of canine leptospira infection in France, for the moment. I gather from Miss Joshua's paper that your knowledge of ictero-haemorrhagic leptospirosis is such as to justify its virtual exclusion from consideration at this Congress. In France, the control of leptospirae not having given any result in severe icterus ("yellows") of the dog, it was believed for a long time that leptospiral icterus did not exist in our country. It was only in 1940 that Troisier, Mme. Kolochine-Erber and Mlle. Sifferlen[1] stated with certainty the existence of the disease during an epidemic in the kennels of the Laënnec Hospital in Paris. There four young dogs died of icterus while their mother was not affected. The experimental transmission of the disease to the dog, the discovery of leptospirae in the kidneys and the isolation of the germ by culture did not allow of any doubt as to the nature of the condition. However, as far back as 1925, Lesbouyries and Verret[2] had succeeded in transmitting icterus from dog to dog, but they had been unable to find leptospirae in the organs of these dogs; on the other hand, they reported having seen leptospirae in the urine of healthy dogs, so they refused to admit the pathogenic character of leptospirae, which had just been established by Okell, Dalling and Pugh. This is why I, for my part, could not accept the opinion of my colleagues as to the regular transmission of icterus, by intraperitoneal injection of urine, from the dog to the guinea-pig. In reality, however, according to Miss Joshua's observation, we must not seek the aetiological diagnosis of the disease as a result of the examination of urine slides, neither with dark field illumination microscope, nor by nitration. It was only when I applied the coloration of the kidney sections according to Dobell-Levaditi's method that I was able clearly to distinguish leptospirae—especially in the kidneys, but also in other organs, for instance in the liver. Thus, in 1946, I was able, together with my assistant Dr. Bertrand, to prove that leptospiral icterus actually was existing in France.[3]

It is easy to diagnose this icterus clinically. We attach the greatest importance to the colour of the skin and mucous membranes; it is orange-yellow, while with other varieties of icterus, such as in tuberculosis of the liver, cancer, retention, etc., the coloration is lemon-yellow. Moreover, the haemorrhages are constant and, which is a remarkable fact, have their seat in the digestive tube, especially the stomach, exactly as in the case of Stuttgart disease, which accounts for the vomiting of blood and the haemorrhagic enteritis. Consequently the two diseases are extremely similar and we may ask ourselves if we are not confronted by two clinical forms of only one affection.

This clinical diagnosis is of the greatest interest because we cannot get any assistance, from the practitioner's point of view, by serological examination. This latter is positive only when the agglutinins are present in the blood, which requires a delay of 12 to 15 days; now, in France, this disease is always acute, lasts only a few days, and causes the death of the animal, in nearly every case, long before the serological diagnosis is arrived at. In all the cases where it was possible to find the agglutinins we had to deal with *L. icterohaemorrhagiae*; we never observed icterus in the *L. canicola* infections.

Experimental diagnosis is very important from the theoretical standpoint and in our studies leptospirosis infection was proved by means of the guinea-pig. The inoculations are made by subcutaneous or, which is preferable, intraperitoneal injection of 2 c.c. of urine aseptically obtained from the dog by a bladder-catheter, this operation being harmless—contrary to the opinion expressed in the paper. The incubation generally lasts about eight days, but may last longer. We consider as a first symptom the appearance of icterus, not that of hyperthermia which, though helpful, is only a prodrome, the significance of which may be doubtful. It is at this moment that we have to take blood to obtain a culture of leptospira. The presence of bile in the guinea-pig's urine is recognisable by chemical analysis 24 hours before the appearance of the cutaneo-mucous icterus. Finally, the autopsy of the guinea-pig shows, besides the orange-yellow icterus, the presence of blood suffusions in numerous organs, especially in the lungs. The leptospirae are easily seen, by Dobell-Levaditi's method, on the sections of the organs.

I am going to say a little more on the subject of the technique of agglutination which we employ, because it is different from that described by Dr. Broom. We use fresh cultures of leptospirae, only four to six days old, and we begin by verifying if they are not spontaneously agglutinated. The dilutions of serum are made at the rate of 1:10, 1:100, 1:1,000, and the results are read after leaving for two to three hours at a temperature of 37° C. Then we search with a dark field illumination microscope for agglutination and lysis. Agglutination is shown by the formation of some sort of hairy chestnuts resulting from the agglomeration of the leptospirae which are seen stirring on the surface; the lysis is observed by a diminution of the mobility and the destruction of the micro-organisms, these becoming less bright, rather greyish, and sometimes appearing in fragments. We consider as positive reactions those in which we perceive lysis and an agglutination at least at

the rate of 1:1,000. Sometimes we observe a zonal phenomenon, the agglutination not being produced in spite of the most concentrated dilution and appearing only in weaker concentrations. Naturally, the antigenic species of the leptospira is shown by the agglutination, but at very different rates, of the various species of leptospirae obtained by the same serum.

As to the aetiology, we do not attribute to the urinary tract the same importance that Miss Joshua attaches to it in her paper. One fact is certain: it is the receptivity of the external mucosae and of the excoriated skin. I have seen icterohaemorrhagic leptospirosis appear in a dog that had been bitten eight days before by a rat, and incline to think of an inoculation of the digestive, nasal or ocular mucosae, by contagious products deposited by rats. Fortunately the leptospirae do not live long outside the animal organism, which restricts the chances of infection. For instance, in Lyons, we find 20 per cent. of the brown rats infected, while cases of leptospirosis are very rare in man as well as in dogs.

The treatment of leptospiral icterus with penicillin has given very poor results and among 15 dogs treated, even speedily, by myself, I have obtained only two successful results. Moreover, the recovered dogs continue, for at least one year, to have an agglutinating serum and to eject leptospirae, from time to time, in their urine. When we know the pathogenic character of *L. icterohaemorrhagiae* for man we cannot help fearing for the health of the owners of these dogs and we must recommend to them the greatest caution.

The leptospiral nephritis which, according to the reports submitted to us, is of such great importance in Great Britain, has just been recognised in France by Brion, Bertrand and Jullien.[4] In all cases it is due to *L. canicola*.

The symptomatology observed by us is as follows: in the acute form we note especially digestive troubles, dyspepsia of the hyposthenic and hypochlorhydric type, with dry mouth, nausea, vomiting and uraemic odour from the mouth; the syndrome of digestive uraemia is then developing. The rate of blood urea increases and reaches several grammes per litre; the urine is scanty and contains albumen and cylinders. In the chronic form we are unable to distinguish leptospirosis from other forms of chronic nephritis, if the agglutination reaction is not positive against *L. canicola*.

The diagnosis is the same as for *L. icterohaemorrhagiae* infection. But the agglutination test renders better service because, the evolution being slower, the agglutinins have time to develop before the patient dies. The inoculation of suspect urine into the guinea-pig results in hyperthermia on the third or fourth day; this again is the moment to take blood for cultures. The guinea-pig dies after eight or ten days, showing icterus only exceptionally; *post-mortem* examination reveals haemorrhagic staining of the lungs.

We agree entirely with our British colleagues as to the greater efficacy of penicillin against *L. canicola* infection than against *L. icterohaemorrhagiae* infection, though I am far from having the same experience as they, because of the rarity of cases studied in France.

On the other hand, it is certain that in France the infection is far from being so widespread as in this country. Indeed, we personally have never met a dog in apparently good health having an agglutinating serum for one of the species of leptospira. There exists only one published observation on this subject, that of Senthille, De Bayo and Mme. Kolochine-Erber.[5] These authors, in 1945, in Paris, saw three cases of human infection, similar to influenza, with patients having an agglutinating serum against *L. canicola*. Four dogs which belonged to these persons were recognised, though in good health, as carrying that organism. It was impossible to state at which moment these dogs might have been contaminated, for nothing in their antecedents allowed us to find a trace of infection.

It is possible that veterinary practitioners, informed henceforth of the existence and clinical aspects of canine infections, will recognise them more frequently. For the moment we believe that we must not fall from one excess into another and see in every insufficiently characterised disease, in every infectious syndrome, a case of leptospirosis. The diagnosis of these diseases still demands support from experimental observations and the assistance of the laboratory will be necessary for some time.

We now draw attention to the fact that the question of Stuttgart disease seems to remain in abeyance. This haemorrhagic gastro-enteritis, in which Lukes discovered as early as 1923 the pathogenic rôle of leptospira, seems to have become less frequent. For our part, we have not seen any authentic case for 20 years. That is to say, it is impossible for us to confirm or to invalidate the rôle of leptospira. However, we have drawn attention to the identity of lesions of the digestive tract with what is seen in the *L. icterohaemorrhagiae* infection.

I know, however, that one of my colleagues, two years ago, saw an epidemic of Stuttgart disease in a kennel of racing greyhounds in the region of Paris, and that the serum of sick and recovered dogs agglutinated with *L. canicola*. These observations will be the subject of a thesis of one of my students and it is difficult for me to dilate upon it on this occasion.

In summing up, the observations that I have made in France show that canine leptospiral infections are much less widespread than in certain other countries of Europe, and especially in Great Britain. There I have recognised the existence of the *L. icterohaemorrhagiae* icterus and *L. canicola* nephritis. The weakness of the infection is demonstrated by the rarity of cases of positive agglutination with dogs that might have been infected and survive their infection. But it is possible that, in reality, such cases are more frequent than they appear to us at present, for, not appreciating the position, veterinary surgeons neglect to demand sero-diagnosis at the laboratory with regard to diseases they classify with difficulty. Perhaps, in a few years, we shall see into the matter more clearly. But for the moment we think that the fact of having identified, in France, the leptospiral infections of the dog is of great interest, not only in veterinary medicine but also in public hygiene.

References

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2 *Rec. med. Vét. Alfort.* (1925.) 59.
3 *Rec. med. Vét.* (1946.) 289; *C.R. Soc. Biol.* (1946.); *Encycl. vét. Période.* (1947.), fasc. 11-12.
4 *C.R. Soc. Biol.* (1948) **142.** 1112; *Bull. Acad. Vét.* (1949.) 71.
5 *Bull. Acad. Vét.* (1945.) 175.

Mr. W. I. M. McIntyre, M.R.C.V.S. (Royal "Dick" Veterinary College, Edinburgh), who was the second opener of the discussion, said: I would like first to congratulate the essayists on their paper, which provides us with so wide a field for discussion. Also, I would like to thank the N.V.M.A. Organising Committee for the opportunity of contributing to this discussion. As the information which I wish to place before you to-day has been accumulated with the help of Dr. R. D. Stuart, of the Department of Bacteriology at the Royal Infirmary, Glasgow, I would like to acknowledge this before we go further.

I propose to arrange my contribution in similar outline to that of Miss Joshua, in order to facilitate discussion.

I have only a few words about dogs infected with *L. icterohaemorrhagiae*. As we have accumulated a series of only 25 dogs which showed blood agglutinins to *L. icterohaemorrhagiae*, we do not wish to make any generalisations. Out of ten recorded cases of clinical icterus in the dog, only five have shown any agglutinins to *L. icterohaemorrhagiae*. I am therefore going to suggest that there is a need to verify a tentative diagnosis of leptospiral jaundice by having the blood examined for agglutinins. If this were carried out, I believe that we would come to recognise other infections associated with icterus just as frequently as *L. icterohaemorrhagiae*.

We turn now to infections in the dog with *Leptospira canicola*, which is the subject of main interest in the essayists' paper.

Incidence of the Infection

While it is almost impossible to estimate the incidence of *L. canicola* infection in a number of truly unselected dogs, the figure of 40 to 50 per cent. given by the essayists is approximately that of several other groups of workers and agrees with 51 per cent. found by Stuart and me in 292 dogs. It may be too high, but it is worth while being so if it will help to emphasise the seriousness of the condition and the urgent need for prophylaxis.

(*a*) *Age.*—Unlike the essayists, we have found it in six puppies under the age of six months. The essayists' contention that it is less common in puppies of under six months could be explained as easily by the fact that puppies are under much stricter supervision as by gonadal stimulation. Here is an analysis of the ages of 66 cases of primary leptospirosis.

TABLE I: PRIMARY LEPTOSPIROSIS DUE TO *L. canicola*

Age	*Numbers*
0–6 months	6
6 months–1 year	30
1–2 years	17
2–3 years	10
3–4 years	1
4–5 years	1
5–6 years	1
	66

This analysis shows that almost 80 per cent. of infection takes place before the age of two years.

(*b*) *Sex.*—In the above 66 cases only five were females, a ratio of 13 males for each female, but here we come up against a lack of standard. How are we to determine the proportion of males to females in a given urban area? None the less this ratio may indicate a relationship with the male dog's greater fondness for investigating with the nose.

(*c*) *Breed.*—We would suggest that the real explanation of the essayists' suggested breed incidence is that the high figures belong to the more popular breeds, and not necessarily to those which are rather low in the undercarriage. Presumably Dr. Broom's 76 mongrels would show a great variation in size. Here is a breed analysis of the same 66 cases.

TABLE II: PRIMARY LEPTOSPIROSIS DUE TO *L. canicola*

Breed	*Numbers*
Fox Terriers	16
Mongrels	10
Cocker Spaniels	9
Collies	8
Alsatians	5
Scotties or Aberdeen Terrier	3
Labradors	2
Bull Terriers	2
Cairns	2
West Highland White	2
Border Terriers	2
Yorkshire Terrier	1
Springer Spaniel	1
Greyhound	1
Pointer	1
Dachshund	1
Total ...	66

SPREAD OF INFECTION

While it is impossible to refute completely the essayists' theory that this disease is an ascending infection of the urinary tract, I do suggest that the evidence put forward is inadequate. If we examine points 1, 2, 3 and 4 on page 5 of the essay, we find that each point could just as readily apply to some other route such as intranasal infection.

Dogs which I have observed usually bring their noses just as close to a warm lamp-post as they do their external genitalia, while keeping their feet well clear of the flavoured area. Certainly, as the essayists admit in the last sentence of paragraph (1), the casual greeting between dog and dog is usually carried out with the nose.

The high incidence put forward by the essayists, of infection in dogs which have been completely immersed in ponds, compared with the low incidence in dogs that have only drunk the water from similar ponds, could also be explained by intranasal infection. Numbers would be a help in assessing the value of this point. I must add that I do not think ponds are a likely source of infection because of the poor viability of *L. canicola*.

It may be of interest at this point to quote Schuffner's explanation of the higher incidence of Weil's disease in male human bathers as compared with female bathers in Holland. He contended that it was due to the fondness of male swimmers for strokes like the "crawl" which allowed water to enter the nostrils, in contrast to the female preference for "side" and "breast" strokes.

Of course in considering paragraph 3 no one will deny the essentially renal character of the disease, but that is no evidence of an ascending infection of the urinary tract. The last sentence of this paragraph reads: "It is therefore not impossible to postulate an ascending infection *via* the urinary tract in some cases at least." I feel the essayists are beginning to weaken at this point.

The figures produced to support the breed incidence of point 4 are not convincing, for reasons already put forward.

I am sorry to be so destructive, but it is very necessary before putting up the contention that the renal infection is of haematogenous origin and not an ascending infection of the urinary tract. The evidence for such a contention is as follows: (1) We have grown *Leptospira canicola* from the bloodstream of nine dogs, and all these strains are still alive. In one case which was allowed to go untreated, the leptospirae were found in the urine ten days later. (2) The serological findings do not favour any infection by way of the urinary tract. It is unlikely that high titres would be associated with a subacute local lesion. (3) The pathology of the kidney lesion and the distribution of leptospirae in the kidney tissues. I am sorry there are no facilities to-day for showing lantern slides, or we could have gone into that in more detail. No discussion on leptospirosis is adequate without consideration of pathological detail. Briefly, the lesion is an acute interstitial nephritis with either a diffuse or focal distribution. The infiltration of leptospirae is peritubular and intratubular without any evidence of invasion from the urinary tract.

It may be of interest to note that in experimental work in guinea-pigs with *L. icterohaemorrhagiae* Stuart found a diffuse peritubular distribution and yet later found intratubular spirochaetes exactly as in canicola cases.

CHARACTER OF THE DISEASE IN DOGS

We have classified our cases into three groups, *viz.*, Bacteraemic, Primary and Secondary renal. Because of the progressive nature of the disease set up by *L. canicola*, we must emphasise that there are no hard-and-fast boundaries between these three groups of cases, but we do contend that they present a logical picture of the disease.

THE BACTERAEMIC STAGE

So far we have recorded nine cases from the bloodstream of which we have been able to culture *L. canicola*. All these dogs had temperatures between 104° and 106° F. Apart from complete anorexia and dullness they showed no other symptoms.

I think we can overcome the essayists' objections to the bacteraemia by saying that in very mild infections this stage may produce little or no malaise, and it may be some cardinal sign of nephritis which first attracts the attention of the owner. At the bacteraemic stage agglutinins are usually absent from the blood, but two cases with high titres were discovered and yet the cultures were successful.

PRIMARY RENAL STAGE

This shows essentially the picture of acute interstitial nephritis, and it may be very severe or it may be very mild. The clinical term "subacute" can be very confusing, because it is often applied to both mild cases of acute interstitial nephritis which readily respond to treatment, and to established cases of chronic interstitial nephritis, and it is most important, from the point of view of prognosis and treatment, that these cases should be distinguished. I presume, when the essayists use the term "subacute" they are referring to mild cases of primary leptospirosis showing a high or rising titre. If this is wrong, clarification would be welcome. I thoroughly agree with the essayists about the wide range of clinical signs shown by these dogs, but I think that too much emphasis is being placed on mouth lesions. I hardly ever see mouth lesions in mild cases of acute or chronic interstitial nephritis. The basis for the serological classification of this group is that they show an agglutination titre of 1:10,000 or a distinct rise in two successive samples of blood at a week's interval. If the titre was below 1:10,000 the first time, it was, almost without exception, over 1:10,000 at the end of a week, *i.e.*, using living cultures as antigen.

In our published series of 60 cases in this group, leptospirae were found in the urine in 37 cases by direct examination; only one case showed icterus.

Secondary Renal Stage

As the dogs recovered from the primary stage of the disease, with or without treatment, leptospirae disappeared from the urine and the agglutination titres fell during a few months to 1:3,000 or lower—usually 1:300 or 1:100—but in the majority of cases a condition of chronic interstitial nephritis was set up and this proved to be a progressive disease. Depending on the severity of the primary attack, the animal may live for only a few months or for a good many years. Other illnesses and external factors will, of course, play their part, but the essential elements are these—fibrosis of the kidney, leading to hypertension, and hypertension leading to more fibrosis and so on until the uraemic crisis ensues. The evidence we have for this part of the story is not yet published, but it consists of a routine examination of urine and blood taken from dogs known to have had primary leptospirosis some months or over a year before. Many of these cases show no clinical signs, and the owners considered them healthy, but the urine showed protein and casts, while the blood urea was considerably raised in some. The agglutination titres remained constant or declined slowly during this period. One two-year-old dog died of chronic interstitial nephritis one year after a moderately severe attack of primary leptospirosis. Others now under observation are progressing to the same termination.

We have been able to re-examine 19 cases known to have had primary leptospirosis six to 18 months beforehand. Of these,

sixteen showed proteinuria,
fourteen showed casts in urine,
ten had blood ureas over 40 mgms./100 mls.,
one two-year-old died of chronic interstitial nephritis with a blood urea of 434 mgms./100 mls.

This excretion of protein and casts is a constant process. From one dog I have taken over 30 samples of urine over a period of several months and each sample produced its quota.

I have quoted from the cases which were known to have suffered from the primary attack. Naturally, since our investigation began we have diagnosed a great number of cases already in the stage of chronic nephritis. These showed the same signs as the cases already mentioned. They became thin and had a great thirst. They were usually dull and had little or no appetite. The breath was often foul. The temperature was normal. The pulse was characteristically hypertensive. Some cases lived for months in this condition. Others proceeded rapidly to the so-called Stuttgart syndrome and death. Agglutination titres remained constant at or under 1:1,000. Blood ureas ranged from 40 mgms./100 mls. right up to 840 mgms./100 mls. before death.

In order to emphasise that chronic interstitial nephritis is not necessarily a disease of the old dog, I give you the following list of figures of cases with their ages. These do not include the above 19 cases.

Table III: Age Incidence of Dogs with Chronic Nephritis and Low Positive Agglutination Titres

Age	*Number*
0–1 year	6
1–2 years	10
2–3 years	4
3–4 years	4
4–5 years	4
5–6 years	0
6–7 years	1
7–8 years	4
8–9 years	1
9-10 years	6
Over 10 years	10
Total	50

When first seen these 50 cases were already in the stage of chronic nephritis. It will be observed that the largest number occurs in dogs between one and two years of age, and these represent the cases that probably were severely attacked in the primary stage, and kidney function has failed rapidly. After two years the casualty rate was lower and steady until old age was reached.

Aids to Diagnosis

Once the clinician suspects leptospirosis, there are several aids to diagnosis which he can use. Blood examinations are best carried out at a laboratory, but urine examination is well within the scope of everyday practice. If the clinician does not wish to trouble with urine, then it, too, may be sent to the laboratory.

1. *The Examination of Urine.*—I am sorry, but I cannot understand the seeming paradox put forward by Miss Joshua whereby she recommends taking two blood samples from dogs and then strongly objects to the catheterisation of the same dog. Surely the surgical technique involved in blood sampling involves just as much risk as, if not more than, catheterisation. However, I will hasten to say that, in my experience, if care is taken there is little or no risk in either procedure. I have taken over 30 urine samples from one dog without setting up any trace of infection. In passing I would like to mention that boiling for five minutes does not destroy a gum elastic catheter even after many attempts.

The urine may be obtained by catheterisation or by patient vigil with bowl in hand, but I would like to contradict Miss Joshua's statement that its examination is of no value as an aid to diagnosis. There are a number of ways in which it is of very considerable value and of a great deal of interest.

First of all, dark ground examination. With the help of a dark ground condenser this is carried out with the ordinary microscope. One drop of urine is put on a slide, covered with a coverslip and examined directly; it is the work of seconds to find the organisms, sometimes as many as six to a field. This is a straightforward task compared with staining preparations for other bacteria and takes no time compared with the tedious process of finding sarcoptic mange mites. To suggest that it is an ultra-scientific task outwith the scope of ordinary mortals is wrong, and all I can ask the "many bacteriologists" who have told Miss Joshua about its difficulty is "Have they seen a positive specimen of urine?" In our published series of 60 cases of primary leptospirosis the organism was found in the urine from 37 of these cases, a percentage of 61. That this phenomenon occurs in the South of England is evidenced by the fact that we have examined samples of urine sent through the post from there, and found them to contain leptospirae. If samples are sent by post, it is an advantage to add a phosphate buffer to neutralise the acidity of the urine. The morphology of the organisms in such samples is quite distinct up to 48 hours. I can assure you that this is no optical illusion, because we have not yet found leptospirae in a urine in which the finding was not supported by a blood agglutination titre of 1:10,000 or by a sharply rising titre. I hope you will forgive me for having gone into so small a point at such great length, but I must emphasise the value of this examination to confirm rapidly the diagnosis of at least half the cases of primary leptospirosis.

Failure to find leptospirae in urine means nothing, but other examination may be helpful. The amount of protein varies, and I agree with Miss Joshua that it is usually small in mild cases but none the less definite. The centrifuged deposit contains a varying number of casts depending on the severity of the attack. These, of course, present irrefutable evidence of a kidney lesion, which, as we shall assert in a few minutes, has a 90 per cent. chance of being caused by *Leptospira canicola*.

2. *Blood Examination.*—The essayists have dealt with the agglutination technique and interpretation, but I would suggest that a second blood sample is not necessary for diagnosis if the titre of the first is over 1:10,000. In this connection I would like to ask Dr. Broom how he classified his 228 acute cases shown in Table III.

Obviously from the serologist's point of view he must have used some dividing line for his titres. He has very kindly given us details of the agglutination technique, so that we can compare his results with other methods such as those using living cultures as antigens. In the absence of leptospirae in the urine the serological examination is very necessary to distinguish acute from chronic cases, in order to advise on prognosis and treatment.

For suspected bacteraemic cases a venule (Bayer's No. 3d) should be used for taking off the blood. Then it can be cultured and the plasma may be used for the agglutination test. I would recommend this procedure particularly to those who doubt the presence of a bacteraemia.

Prognosis

Out of 25 published severe cases of primary leptospirosis only five, or 20 per cent., recovered.

In 35 mild cases recovery was 100 per cent. But this recovery was not complete, as the majority of these cases continued to show evidence, by blood or urine examination, of a chronic nephritis without necessarily showing symptoms.

Accurate prognosis is often a very difficult task, and I have found the estimation of blood urea to be a great help. This, of course, can be done on the serum sent for agglutination. Several cases which appeared clinically bright and cured were found to have a blood urea of over 300 mgms./100 mls. and were dead a few days later. In the medical literature on chronic nephritis similar instances are recorded.

In primary leptospirosis I have found a blood urea of over 200 mgms./100 mls. to be of very serious significance and one of over 350 to be fatal.

In chronic nephritis any rise in the blood urea is serious, and dogs in which it is over 150 mgms./100 mls. do not live long.

I cannot overestimate the usefulness of this knowledge in dealing with the prognosis of chronic nephritis.

Treatment

I have found penicillin to be a direct specific for primary leptospirosis, but the response depends largely on the extent of damage to the kidneys. No amount of penicillin will heal a shattered kidney. This, I suggest, is the chief cause of the disappointment, referred to by Miss Joshua, felt by veterinary surgeons in the lack of response to penicillin. An estimation of kidney function would make this clear. The other point to remember in the absence of serological evidence is that the animal's so-called subacute condition may really be a chronic nephritis. Subcutaneous glucose-saline is invaluable in the dehydrated dog.

Prophylaxis

I congratulate Dr. Broom on his recent publication on a prophylaxis experiment on hamsters. I trust that the vaccine will soon be available for general use, as this is the only satisfactory way of combating a disease which has so disastrous an aftermath.

Aetiological Significance of *L. canicola* in Nephritis in the Dog

Miss Joshua states that 50 per cent. of cases (number not quoted) showing nephritis assessed on purely clinical grounds were reactors to either species of leptospira. Miss Joshua suggests that the figure of 90 per cent. put forward by Stuart and me is based on assessing renal damage on an arbitrary blood urea level of 40 mgms./100 mls. In order to put the figures beyond such arbitration we have raised the blood urea level to 80 mgms./100 mls. and have produced the following figures:—

Table IV

Dogs with blood urea of over 80 mgms./100 mls.		*Dogs with blood urea under 40 mgms./100 mls.*	
Number	Number showing leptospiral agglutinins.	Number	Number showing leptospiral agglutinins.
93	78	160	54

This shows that 84 per cent. of dogs showing renal damage assessed on a blood urea level of 80 mgms./100 mls. have agglutinins to *Leptospira canicola.*

I would suggest that the real arbitrary factor in our different figures is Miss Joshua's assessment of renal damage on purely clinical grounds. We cannot seriously discuss the incidence of nephritis in any animal in the absence of urine analysis, blood urea estimations, some other renal function test, or *post-mortem* examinations.

The Risk of Human Infection

Once the medical profession begin to look for infections caused by *L. canicola* I think many more cases will be found.

One female client, who brought a four-month-old Aberdeen Terrier with active leptospirosis to our Clinic, contracted the disease, and we were able to be of assistance to the doctor in tracing the condition. She complained chiefly of muscular pains and headaches with pyrexia. It is interesting to note that the woman herself informed us that she had gone round the house wiping up puddles left behind by this puppy.

A young veterinary surgeon in Scotland has just recovered from a severe attack, which was first thought to be poliomyelitis. He suffered a great deal of muscular pain and lost the power of his legs, but has now recovered. He had been bitten by a dog known to be in the primary stage of leptospirosis.

The risk is there and should be reckoned with in our handling of these cases.

. . . . . .

General Discussion

Major L. P. Pugh (Sevenoaks): The authors of the papers had put leptospirosis "on the map" and brought forward the problem of treatment and a great debt of gratitude was due to them. In his district 25 years ago Weil's disease was very common and its incidence was greatest during the first eight or nine months of life. It was definitely haemorrhagic in various parts of the body, especially the lungs. The hyperacute form appeared in a fair percentage of cases, and there were also gastro-intestinal cases. In acute nephritis the leptospira were present for a few weeks, but one did not get the chronic nephritis which one saw now when only the haemorrhagic form existed. The renal form existed at the moment in the proportion of one haemorrhagic to four canicola cases and there was a suggestion in his area there had been a gradual transition in the pathology of the acute *Leptospira icterohaemorrhagiae* case. The organism had become more adapted to an attack on the kidney and if this tendency persisted it might ultimately become as well adapted to the kidney of the dog as to the kidney of the rat. The fact, pointed out by Miss Joshua, that young puppies did not seem so susceptible to the renal form of disease rather suggested that human beings might not be so susceptible to it as they were to the acute icterohaemorrhagiae form.

Dr. J. Cauchi (Ministry of Health): Public health officers were extremely interested in the question of the cat being a possible source of leptospirosis in man. For some years there had been a progressive increase of instances of food poisoning in this country and naturally there was a proportionate drive for the improvement of conditions under which food was kept. Such measures of control for improved hygiene included measures against rodent infestation. Naturally the more scientific measures of rodent control included systematic poisoning and shutting out of the rat from buildings and so on, but there were at present circumstances which limited building operations, the making of structural alterations in existing buildings, or the erection of new buildings, and it was the practice in many catering establishments to keep cats as one of the means of keeping down the rats.

Sanitary inspectors were often in a difficulty to know how far they were justified in condemning such a practice and it would be most helpful if an authoritative opinion could be given as to whether the keeping of cats in food shops or catering establishments, in spite of the additional advantage in the control of rats, should be condemned. Control was particularly important because many of the cases of food poisoning were due to salmonella organisms.

Dr. Agnete Krabbe (Copenhagen) spoke about treatment of the condition with penicillin. She said that there were only a few specimens each year of the icterohaemorrhagic form of the disease and a good many cases of the canicola form. With penicillin one was able to clear the urine of infected dogs and the *L. icterohaemorrhagiae* disappeared from the bloodstream very quickly. When treatment was started very early one could not be sure whether the infecting organism was the *Leptospira,* nor was it possible to tell how serious it might be, and in such circumstances it was difficult to judge the value of penicillin. In the last few years she had seen many cases of leptospirosis with very slight symptoms; investigations had been made on 100 dogs selected from among those treated at the Clinic and it was not known whether the cases were due to natural spread or to widespread vaccination.

Mr. H. I. Field (Cambridge): Dr. Broom had given an excellent review of the literature relating to leptospiral infection in man and animals, while Miss Joshua's contribution showed the value to be derived from careful clinical study. The discussion had very naturally centred around leptospiral infection in dogs and cats, but he felt that it would be unfortunate if the meeting closed without attention being directed to the possibility of leptospiral infection occurring in this country among the food animals.

Dr. Broom had referred to infection in pigs. The existence of this type of infection had not been established in this country, but the symptoms of porcine leptospirosis appeared to be relatively mild, so that it was quite possible that the infection did occur without its being recognised. Again, it was quite possible that the

leptospiral infections of cattle reported from Russia, Palestine and the United States might also occur in this country. In particular, it might be mentioned that one of the symptoms of the common form of bovine leptospirosis was haemoglobinuria. This was a not uncommon symptom of disease in cattle in this country apart from that form associated with Babesia infection. The possibility of this type of case being due to leptospiral infection had not been investigated.

He would like to ask Dr. Broom one question relating to the disease in pigs: was diagnosis based on the isolation of the organism from an infected pig or was it necessary to resort to animal inoculation?

Dr. M. L. Levi (Royal Veterinary College): As far as his experience went, which was mainly ward experience, he would support Mr. McIntyre in his advice to resort more often to catheterisation of dogs, male or female. Fifteen years ago in France in the Alfort School the method was used as a routine; male and female dogs were catheterised without any serious accident; it was easily done and supplied useful information.

He would congratulate Dr. Broom on his cautious attitude to vaccination. The assessment of the value of a canicola vaccine in the field was bound to be very difficult. Dr. Broom found that hamsters could be protected against experimental *L. canicola* infection by the use of culture vaccines. If similar studies could not be carried out on dogs it might be advisable to experiment on ferrets. The susceptibility of the latter to leptospirae required further investigation however.

The Replies

Dr. Broom: Professor Brion, who used living cultures, raised the question of the height of agglutination titres. The speaker preferred killed, formolised suspensions because he considered that they gave more constant results. That was a personal predilection, but there was often a considerable difference in the titres when a serum was tested by two methods. It was not possible, therefore, to compare directly the results obtained with formolised suspensions and with living cultures. Professor Brion remarked that guinea-pigs infected with *Leptospira canicola* regularly died after eight days, with typical symptoms. That had not been his experience, nor that of other workers. The only satisfactory animals were young hamsters: they could always be infected, whereas guinea-pigs were generally resistant. In infected animals one could often see living leptospirae in the peritoneal fluid three or four days after inoculation, long before any signs of infection showed. Professor Brion mentioned that he had never found any healthy carriers, and this also differed from the speaker's experience. On a number of occasions apparently-healthy dogs had been found to be excreting large numbers of organisms. Professor Brion mentioned Senthille's papers. There was a similar article by Schüffner and his colleagues in which they described how a dog, a bitch and a litter of puppies were all infected. The animals showed no symptoms, but they transmitted the disease to three humans.

With regard to Mr. McIntyre's comment on Miss Joshua's remarks concerning dark field microscopy, the speaker was primarily responsible for the opinion expressed. While there was not the slightest doubt that, in experienced hands, the method was satisfactory, he had known many people confidently diagnose as living leptospirae what were in fact blood filaments. In his series of cases the differentiation between acute and chronic was purely clinical; the diagnosis was made by the clinician who sent the material.

Recognition of *L. canicola* infection in man was certainly increasing in this country. In 1946 Dr. R. D. Stuart diagnosed the first case; in 1947 there were four known cases; last year there were 15, and up to the present this year he had seen ten. It was probable that clinicians were becoming more conscious of the condition, rather than that there was an actual increase in incidence.

He thought Major Pugh's view was correct that *L. canicola* had a much lower pathogenicity for man than *L. icterohaemorrhagiae*. It seemed likely that human beings must often come into contact with the organisms, but the majority did not become infected.

On the question of the importance of cats, he wanted to make it quite clear that the titres found were extremely low. More evidence was required before deciding that cats became infected in a clinical sense with *L. icterohaemorrhagiae*, and thus a source of danger to man. Cats in Indonesia were frequently infected with *L. bataviae*, but this organism had not been found in this country. As far as food establishments were concerned he would think that clearing out rats was much more important than any slight risk which might result from the possible infection of cats.

In answer to Mr. Field's question about the diagnosis of leptospirosis in pigs, this could be carried out either by culture or by agglutination tests. At present there was no known rodent carrier of *L. pomona* in this country, although certain local rats had been suggested as carriers in Australia.

He believed that *L. canicola* vaccine would soon be on the market. He had heard only recently that a similar vaccine had been in use in Denmark for some time, and had proved satisfactory.

Miss Joshua, also in reply, said that it seemed from what had been said that the position of leptospirosis in France to-day was much the same as that described by Major Pugh in the middle twenties in this country and that the renal form was replacing the acute icteric form even when the infecting organism was *L. icterohaemorrhagiae*. Professor Brion had made the point that agglutinins persisted in the blood for a year after the infection had clinically passed. She suggested that they persisted, in fact, for life, in a gradually decreasing titre; the average titre in the old dog was 1:10 up to 1:30, but there were dogs which showed a titre of 1:300 and it seemed probable that they had a residual renal infection. Professor Brion's experience of finding leptospiral organisms in the urine up to one year was the longest recorded so far.

There seemed little doubt that in Mr. McIntyre's area the disease differed somewhat from that met with in the south; this area variation was not uncommon and was general to many infective diseases. She was surprised at the age incidence; her numbers in the six to 12 months' old puppies were very much lower. She appeared to have flown a successful kite in suggesting an ascending infection in these cases! With regard to immersion, the infection appeared to be very much more common in the case of dogs which went into water habitually rather than in those which merely drank from the pond, and as both categories would presumably be exposed to infection *via* the mouth and nose the difference between the two groups did seem significant. She agreed that the breed incidence might not be indicative but the Scottish terrier still remained the breed in which the clinician regarded the infection as most common and the Scottish terrier had decreased in popularity in the South of England in the last ten years. She had not seen any bacteriaemic cases of canicola infection; the clinician did not see cases until they were showing some renal symptoms and temperature rise in these cases was uncommon.

She admitted that her classification of nephritis was rough; she used the term "sub-acute" as she wanted her remarks to be understood particularly by clinicians. The classification of nephritis in dogs was very incomplete. In the term "sub-acute nephritis" she intended to include what she would describe as the flare-up stage of chronic nephritis met in middle-aged and old dogs. She was surprised that Mr. McIntyre did not consider that mouth lesions were common; even in the slightest cases careful examination of the mouth revealed some change. She did not suggest that ulceration occurred, but there was a dryness of the buccal mucosa and of the dorsum of the tongue which could be seen quite easily. She agreed that albuminuria did persist in the majority of cases; even in cases seen and treated early it persisted for many years. Although she agreed that chronic nephritis did occur in young dogs she could not agree with the figures given by Mr. McIntyre, but again she would suggest that there was obviously a difference in the type of disease with which they were both dealing.

With regard to the use of the catheter, she was sorry, but she was brought up in a surgical school which deplored the use of the catheter. She was well aware that bacteriologists used it and she knew that they used it at teaching institutions, but she was going to suggest that one did not get the come-back in hospitals which one met in private practice. Many young graduates who had come away from college convinced that they could use a catheter safely had found that they had to give it up. That was purely a personal opinion but she was going to stick to it.

She did not suggest that in dark ground microscopy it was not easy to recognise leptospira, but to the inexperienced examiner negative slides could be very confusing and it was important that one should not identify in urine leptospirae which were not there.

So far as the use of penicillin was concerned it was not only in cases of *L. icterohaemorrhagiae* that the result of penicillin was uncertain. Both Miss Freak and herself had emphasised that it was only in primary, uncomplicated cases of *canicola* infection that penicillin gave spectacular results. Many cases of *L. canicola* infection were not seen in the primary illness and it was not reasonable to expect an antibiotic to give results in the so-called secondary renal stage, yet it might be difficult to differentiate these two types of cases clinically.

She was sorry for the confusion over the question of the proportion of kidney cases which proved to be reactors to leptospira, but of the cases showing nephritic symptoms, or evidence of kidney damage, which she observed, actually half of the dogs were serologically positive and 50 per cent. of dogs showing evidence of kidney damage were found to be completely negative serologically. A number of chronic cases had been found in an acute uraemic phase.

So far as prophylaxis was concerned she thought they differed solely on area grounds; although leptospirosis was reasonably

(*Concluded at foot of col. 1, page 724*)

THE POULTRY INDUSTRY AND THE VETERINARY PROFESSION*

By

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From a fairly wide experience of the poultry industry it is quite safe to say that the majority of poultry farmers feel that the veterinary profession as a whole are uninterested in, and have little knowledge of, poultry disease. Many practitioners, faced with a poultry problem, exclaim that they know nothing about "hens!" This attitude has undoubtedly shaken the confidence of the poultry farmer in our ability to help him. The tendency has been to rely mainly on advice from lay advisory officers—although, in fairness to them, it must be admitted that they have been, in the past, the only available source of information to the farmer. The diagnosis, treatment or control of disease, whatever the species of animal involved, is essentially a problem for this profession and there should be no tendency, as in the past, to delegate the work to laymen.

Our training in the basic subjects should enable us to deal equally well with any form of livestock—it is only a question of applying that knowledge to the specialised type of husbandry involved.

Probably the main reason for the apathetic attitude of the profession towards poultry is failure to appreciate the magnitude of the industry and the part which it plays in the national and agricultural economy.

Many people still regard poultry farming as a few mongrel birds kept as scavengers around the farm buildings to earn pin-money for the farmer's wife. Nothing is farther from the truth: the industry is well organised and mainly in the hands of specialists—pedigree breeders, hatcherymen, egg producers; these last often keeping relatively large numbers of birds on a small acreage.

The general farmer has also adopted more scientific methods, and now usually runs his poultry as an integral part of his cropping system; in many cases he has established a specialist poultry section. Too often in the past the poultry have been left to the odd-job man; it is now recognised that poultry keeping is economic only when sufficient fowls are kept to justify a full-time attendant.

Owing to the short reproductive cycle of the fowl, scientific methods of husbandry—particularly breeding and nutrition—probably have reached a higher level than with any other form of livestock.

The average poultry farmer is better read, and has a better appreciation of the scientific aspect of his vocation, than other types of farmers.

Far from being the Cinderella of agriculture, poultry became, before the war, the third most important branch, with an annual net output of over £30 million—greater than the total value of the wheat, barley and oat crops. It represents more than 10 per cent. of the total agricultural and horticultural produce of this country, and ranks next to the livestock and milk industry. This figure takes no account of the many by-products from the industry, or of the employment and wealth brought to the ancillary trades—foodstuff compounders, millers, appliance manufacturers, timber and metal trades, etc. It is impossible, too, to put a figure on the part the fowl plays in maintaining soil fertility on the farm, market garden, orchard, allotment and glasshouse.

One of the outstanding features of poultry keeping is the wide extent to which it is practised by the population generally—particularly since the war. In fact, poultry keeping is probably the most widely practised form of animal husbandry in this country and the only form practised to any large extent in urban areas. In 1938, there were more than half a million persons engaged in keeping poultry on holdings exceeding one acre; and there are many million domestic poultry keepers. The total poultry in the country was estimated at 85 million. Although the poultry population was nearly halved during the war, it has shown a rapid expansion and the gross annual value in 1948 was estimated at more than £100 million. The actual egg output in 1938 was in the region of 4,500 million eggs, and the figures for annual consumption per head of population were assessed at 145 eggs and 4.6 lb. of flesh. There is undoubtedly a consumer demand for this lighter type of diet, but the industry has a tremendous potential expansion before it, if it can even approach the consumption rate in the U.S. of 380 eggs and 25 lb. of flesh per head per annum.

Expansion and Mortality

The phenomenal growth of the poultry industry between the two world wars was accompanied by a concomitant rise in the mortality rate. The curve for the poultry population expansion from 1918-38 is practically identical with that for mortality over the same period. The number of poultry increased from 15 *million in* 1918 *to* 85 *million in* 1938; the industry doubled in a decade, and quadrupled in less than 30 years. The mortality rate rose from 5 per cent. in 1920 to 10 per cent. in 1930 and 21 per cent. in 1936.

The Poultry Technical Committee set up to investigate this mortality rate in 1936 estimated the financial loss from disease to be £4 million yearly. To-day that loss from disease and mismanagement has been placed as high as £20 million. Expressed as loss in rations, disease has been estimated to cost this country 500 million eggs and 10,000 tons of poultry meat each year. In 1947 one disease alone—fowl pest—caused the slaughter of 200,000 birds and compensation of approximately £200,000: this takes no account of the potential egg loss or trading loss to the industry as a result of standstill orders, or the cost of veterinary manpower to implement legislation.

The expansion of the industry, which was largely blamed for the mortality problem, was due, in a great part, to the large numbers of ex-servicemen from the last war, to whom

* Central Veterinary Society: One-day Poultry Conference.

common in her practice area she was not convinced that it was sufficiently common in young dogs to justify recommending routine vaccination although on public health grounds it was desirable.

With regard to Major Pugh's remarks, she agreed that there was a decrease in the number of acute ictero-type cases and that the renal form was increasing. Concerning Dr. Cauchi's observations, she agreed with Dr. Broom that obviously the keeping down of rats was more important than this possible slight risk from positive cats. In the majority of cases the presence of a cat was sufficient to prevent heavy rat infestation. Neutered cats were not so dirty in their habits as the uncastrated tom.

Dr. Krabbe implied that many cases which responded to penicillin were spontaneous recoveries. She did not think she could agree with that; in the slight cases spontaneous recovery was not uncommon, but one felt that penicillin undoubtedly had hastened clinical recovery. She would emphasise *clinical* recovery because the experimental work of Brunner and Meyer was of importance and confirmed her own impression of persisting kidney damage in clinically recovered dogs.

The Chairman thanked the authors, the openers of the discussion and all those who had taken part in an interesting meeting.

poultry farming appeared an attractive proposition giving outdoor occupation. Egg prices were at a high level and in some depressed areas widespread unemployment led to an influx of men from other industries—a great body of recruits, many of whom had insufficient experience or stock knowledge. The story as stated by the P.T.C. was that of " a machine breaking down under the stimulus of its own momentum."

The influx of new farmers led to an increased demand for stock, for hatching eggs, chicks, cockerels—which the comparatively few established breeders had difficulty in supplying. High prices could be commanded for breeding stock and eggs, and this had a two-fold result; first, men with little stock sense were attracted to invest in, and set up, large farms merely as a speculation; while, secondly, keen but inexperienced commercial egg producers were tempted to become breeders, and the decline in general agricultural prosperity led numerous general farmers to increase their poultry stocks too hurriedly.

The Committee stated that, " This rapid expansion and demand for stock was an inducement to use methods unsuitable to the accelerated production of hatching eggs, with no reference to their health, hereditary disease or suitability as stock birds became common. Large cabinet incubators were used to produce day-old chicks, whilst intensive methods of rearing chicks, and (later) battery brooders were employed. These methods in themselves are not faulty, but when one considers the unsuitability and lack of disease control on many of the supplying farms, the rapid spread of disease is not surprising. Unscrupulous breeders obtained stock from well established breeders, entered them in laying trials and by that means provoked a demand for stock which they were unable to reproduce.

" The rapid development of hatcheries led to a large sale of hatching eggs to hatcheries. Competition led to price cutting in hatchery chicks, with a consequent reduction in standards adopted and in the class of eggs bought by hatcheries. This applied not only to hatcheries but also to pedigree breeders whose stock had been in demand; and many breeders mated immature pullets for supplying commercial needs. Dealers were buying from open markets for resale bulk supplies of hatching eggs and surplus chicks which were often subjected to adverse conditions before finding a home. Auction sales also played an important part in the dissemination of inferior and diseased produce. There is evidence that such sales were used as outlets for B.W.D. reactors and for the survivors of chicks and adults from outbreaks of disease. The exposure of day-old chicks in auction has also been condemned. Many dealings in poultry were done through Press advertisements and many cases are known of men advertising as breeders who had neither farm nor poultry.

" There has also been a tendency to breed from hens of high egg yields irrespective of their merits as breeding stock. The results of egg-laying trials have often been abused in this way—an owner may enter a pen of specially selected birds in a trial and gain high awards although the birds may be in no way representative of his flock. Finally, errors in husbandry have been a contributory cause of many outbreaks of disease—overcrowding in particular."

The mortality figures quoted are based on records from laying trials—these birds purported to come from the best flocks were selected with great care and while at the trials they were managed efficiently, yet one out of every five birds died. This excludes infectious disease, which in certain areas has nearly decimated the poultry population (Newcastle disease, cholera outbreak in 1933, infectious laryngo-tracheitis, typhoid, B.W.D. and salmonellosis, fowl pox and coccidiosis).

This growing death-rate is an index to what was happening in the industry as a whole. The advisory economist at Harper Adams carried out a survey of commercial farms since 1931 and showed an increase from 9 per cent. in 1930 to 15 per cent. in 1936. In a similar survey rearing losses were shown to be enormous, and the number of pullets remaining after six months, expressed as a percentage of eggs set, ranged from only 16 to 19 per cent. Statistics from Aberystwyth showed a mortality in 1934 of 17 per cent., in 1936 of 19 per cent. and in 1937 of 23 per cent.

These figures may be criticised on the grounds that they were compiled some 10 years ago, and when mortality was at its peak. This is admittedly true, and, judged by our records from the National Laying Test, mortality did show an appreciable and steady decline during the war years from 17 per cent. to 11 per cent. in 1945. But an increase became apparent throughout the country during 1946-47 and there is every indication that this increase is being maintained. Furthermore, the decline accompanied the wartime reduction in our stocks. The industry is again undergoing an expansion and the tragedy of the 1930s may be repeated unless we are prepared to join in the battle to the fullest extent—not only through the State veterinary service to the Ministry's stock improvement scheme but also in our daily practices. New diseases have made their appearance in this country—probably as a result of war-time conditions—pullet disease, six-day chick disease, infectious bronchitis; the incidence of salmonellosis has increased enormously, and there is every reason to believe that the leukosis complex is on the increase.

In a recent American publication it is stated that mortality is a more costly item in egg production than labour, and ranks next to feed cost in the expense of producing eggs (or 8d. per dozen). If mortality is 15 per cent., the profit per bird is nearly three times that when mortality is between 15 and 25 per cent. Mortality over 25 per cent. results in a trading loss. It is suggested that, if mortality is as high as two birds per 100 per month, the balance sheet will show a loss.

The Main Causes of Mortality

Reliable information on the causes of mortality is available from two sources: (1) our records of the *post-mortem* examination results from laying trials; and (2) our records of specimens sent in from poultry farmers.

The former records are limited to birds in their first laying year, and infectious disease plays an insignificant part in view of the methods of management. In laying trials the leukosis complex (*i.e.*, fowl paralysis, lymphomatosis and leukæmia) was the highest single cause of death, with a mortality rate of 23 per cent.; this was followed by breakdown of the reproductive system (20 per cent.), and by non-specific conditions, such as visceral gout (7 per cent.), degenerations of the liver (5 per cent.), and digestive trouble (5 per cent.); internal parasites accounted for 7 per cent.

In the second case we can divide our mortality into age groups:—

1. *Losses during Hatching and Young Chicks.*—The proportion of chicks hatched varies from 60 to 75 per cent. of eggs set, and an examination of our records shows that the main losses were from B.W.D. (33 per cent. of all specimens examined), followed by coccidiosis 15 per cent., salmonellosis 5 per cent., rickets and other vitamin deficiencies (2 per cent.), aspergillosis (1 per cent.) and a miscellaneous group due to mismanagement such as chilling, nutritional disorders, etc., amounting to 40 per cent.

2. *Mortality in Growing Stock.*—In the early rearing stages the main losses are from duodenal coccidiosis, worm infestations, coids, contagious coryza, and brooding troubles, associated with overcrowding and dietetic deficiencies. The later stages of rearing and immediately before maturity are probably the most dreaded period for the poultry keeper. The losses in maturing stock of 4-6 months of age from duodenal coccidiosis and fowl paralysis have been enormous, commonly in the region of 30 per cent. Internal and external parasites are also common at this stage, and outbreaks of coryza and other respiratory infections can cause losses from deaths and culls of 50 to 70 per cent.

3. *Mortality in Mature Birds.*—Heavy losses in mature birds are not so serious as a rule, unless actual epidemics occur, such as the present epizootic of Newcastle disease. The main losses are from lymphomatosis, tuberculosis, fowl pox (still very much of a problem) internal and external parasites, pullet disease and non-specific disorders, such as egg peritonitis, fatty liver, visceral gout, crop binding, prolapsus, etc. The most common epidemics are fowl pox, fowl typhoid, coryza and, more rarely, I.L.T. and fowl cholera.

Control of Poultry Disease

The only scheduled diseases are fowl plague and Newcastle disease, under the Fowl Pest Order of 1936; but other Orders deal with the importation of poultry and hatching eggs (this has been of considerable success in the eradication of fowl cholera and infectious laryngotracheitis), and the Poultry Markets and Receptacles Disinfection Order.

The most important scheme for the control of poultry disease, however, is incorporated in the Ministry of Agriculture's Accredited Poultry Breeding Stations Scheme, now known as the Poultry Stock Improvement Plan, and the Accredited Hatcheries Schemes. Both are voluntary schemes aimed at stock improvement and the establishment of sound, healthy flocks for the dissemination of stock.

There are now 4,500 fully accredited flocks and over 500 probationer flocks, involving 3,000,000 breeding stock and 32 accredited hatcheries. It can be said fairly safely that practically all breeders of any size are within the scheme. Although it is voluntary, once a farmer is in the scheme, the regulations are compulsory, and failure to comply with them means loss of accreditation and loss of supplementary rations. The administration is by the N.A.A.S., the disease control being carried out by the Ministry's veterinary inspectorate.

Briefly, the main objects of the Accredited Scheme are to assist poultry keepers in obtaining healthy stock of good quality and to combat the spread of poultry disease. Stations which comply with the regulations are accredited by the Ministry of Agriculture, and a register of stations so accredited in England and Wales is published by the Ministry each year.

With regard to the veterinary side, the greatest emphasis is laid on the eradication of B.W.D. All mature fowls must be blood-tested for this disease by the Ministry and all reactors have to be slaughtered at once and removed from the station. Retesting of all in-contact birds is carried out at 21-30 days' interval until no reactors are found. No fowl must be bred from until it passes a blood test.

In addition, there are certain general disease requirements. Any mortality must be notified at once to the authority and carcases sent for examination to the Ministry's Veterinary Laboratory. If any infectious disease is diagnosed, a veterinary inquiry is made on the farm. In certain cases the station holder may be required to suspend sales of hatching eggs, day-old chicks or stock birds, until the disease has cleared up, and a station holder may be asked to notify certain outbreaks to his customers.

The objects and regulations governing the Hatchery Scheme are similar. All plant and equipment is inspected and must have a total egg capacity of 24,000 eggs. Only eggs supplied by fully accredited farms can be incubated, and hatchery premises must conform to certain standards of hygiene and sanitation. Formaldehyde fumigation and other disinfection must be carried out after every hatch, and minimum standards are laid down for this purpose. Copies of the rules and of the register can be obtained from the County Advisory Officer or from the Ministry of Agriculture, Poultry Branch.

The Profession's Part

Owing to the relatively large numbers of poultry kept, usually in close contact, disease tends to occur as mass outbreaks and the health of the flock as a whole is of more importance than the well-being of any of its component units. With the exception of certain chemotherapeutic agents, the treatment of ailing poultry seldom can be recommended and the control of disease must in the main depend on legislative measures reinforced by advisory work on hygiene, nutrition and breeding and by the use of biological agents.

It is appreciated that the relatively small individual value of the fowl makes it difficult for poultry to be included in a busy practice. But most enlightened poultry breeders are aware of the need for preventive rather than therapeutic control of disease, and of the menace of epidemic disease, and they are eager to obtain authoritative advice on hygiene and eradication programmes.

Furthermore, poultry do not lend themselves readily to clinical diagnosis, and the majority of diseases require laboratory facilities for their confirmation. The profession can probably best assist by increasing such diagnostic facilities, by encouraging a larger number of practitioners to interest themselves in the diseases of poultry, and particularly by encouraging more young graduates to specialise in this type of work.

There is, of course, tremendous scope for the veterinary scientist in the investigation of fundamental and applied problems in connection with the diseases of poultry. The Ministry's veterinary staff are now taking an ever-increasing part in the control of poultry diseases, and a knowledge of this subject is also essential in such spheres as that of the Veterinary Investigation Officer. The Animal Health Trust has established a Research Station solely for this work.

Veterinary pathologists and parasitologists have produced much valuable work on the etiology, epidemiology, treatment and control of the commoner diseases; but it is the interpretation of their work in the field which will bring about reduction in mortality. Furthermore, the expansion of the industry will, to a large extent, take place on the general farm where the practitioner is likely to be called in to an increasing extent for consultation on poultry problems.

The mortality in poultry—probably greater than in any other form of livestock—is likely to become even greater in an expanding industry, and is a challenge to the whole veterinary profession.

CLINICAL COMMUNICATION

TREATMENT OF CATTLE MANGE

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COOPER TECHNICAL BUREAU, BERKHAMSTED

INTRODUCTION

Cattle mange caused by *Sarcoptes scabiei* var. *bovis*, is probably a commoner condition in this country than is generally realised. It is most liable to occur in beef breeds during the winter months.

The period of heaviest infestation occurs during November to April when the animals are housed and in close contact. Even advanced cases appear to recover during the summer when at pasture, but the condition usually reappears when the animals are again housed in the winter. As in the cases reported below, the yards were left empty for a period of over six months, and as the life of mites off the host is usually found to be of short duration, the possibility of the infestation being maintained in the buildings is unlikely. One must, therefore, consider the probability of the disease being maintained in the latent stage on a few animals. As the animals we were treating were 2½-year old fattening bullocks, infection could have been contracted from carrier animals when the animals were housed in the late autumn.

The symptoms of infestation did not show till the temperature became more suitable in winter for the development of the mites. Such a sequence of events would bear a resemblance to the latent phase found in sheep scab, and this process of infestation appears to be the most likely cause of the disease appearing year by year on the same premises.

As the infestation develops, raw patches appear on the back around the root of the tail, and both sides of the neck, and between the hind and fore legs. The animals tend to rub against the posts and walls until marked scab formation occurs, and in advanced cases there may be considerable loss of hair.

Cattle mange can be confused with several other skin conditions, notably an infestation of lice. Correct diagnosis in the early stages of infestation is most important if control measures are to be applied in time to prevent serious loss of condition.

So that a definite diagnosis can be made, a skin scraping must be taken and examined microscopically. It is usually found that the mites are most frequent on the edge of the lesion, and to obtain good results, the scrapings should be deep enough to draw blood.

An immediate examination of the scraping may be successful in demonstrating the mite, but frequently the skin debris has to be heated with 10 per cent. caustic potash and centrifuged before a definite diagnosis can be made.

DETAILS OF THE OUTBREAKS

During the winters of 1946, 1947 and 1948, experimental work in the treatment of sarcoptic mange in cattle was carried out in Lincolnshire. Herds of about 70 Lincoln Red cattle were treated on each occasion. The animals were housed in both open and covered yards, and were kept in groups of 15 to 20.

Each winter during this period the symptoms of sarcoptic mange appeared at about the end of December. The animals rubbed and scratched continually until raw scabby areas had developed around the tail and neck. Diagnosis was easily confirmed by examination of skin scrapings.

The extent of infection varied in the groups, but by mid-January all the animals were affected. In all cases the condition was progressive and the animals lost a great deal of condition as the infestation extended.

TREATMENT

Benzene-hexachloride, which has proved so successful in the treatment and cure of sheep scab (Downing, 1947)[1], was the insecticide of choice and was used for the treatment of each of the three herds concerned. It was used in the form of a 50 per cent. wettable powder or paste which mixed with water to give the suspension containing the appropriate amount of insecticide. Various concentrations were employed during the course of the observations, and the concentration finally chosen as uniformly satisfactory was 0·25 per cent. B.H.C. (equivalent to 0·031 gamma isomer). At this strength where an early diagnosis was possible, one treatment produced immediate clinical recovery, but for general use, and to achieve a complete cure, in doubtful cases, two treatments at this concentration appeared desirable.

The ideal interval between treatments can only be guessed at, since our knowledge of the life cycle of

Sarcoptes scabiei var. *bovis* is not complete. Heilsen (1946)[2], studying the life cycle of *Acarus scabiei* of human beings, concluded that development from egg to egg takes from 14 to 17 days. Gordon *et al* (1943)[3] studied the life cycle of *Notoedres notoedres* in white rats and concluded that it closely resembled that of Sarcoptes, the development from egg to egg taking 17 days.

In our trials treatment of the herds at ten-day intervals gave satisfactory results, but it was not possible to be dogmatic on this point with the experimental methods used. The selection of a treatment interval must remain arbitrary until such time as the exact life cycle of the parasite has been worked out.

Method of Application.—The application of the insecticide to each of 70 Lincoln Red steers without proper facilities for catching and securing the animals proved a considerable undertaking. During the initial treatments each animal was caught, secured, and then sprayed with a stirrup pump. A fairly coarse spray was employed, and approximately 2 gallons of wash was required for each animal. This method proved laborious as the animals, being loose in a yard, were difficult to catch, and when caught and secured, often struggled against treatment. Subsequently it was decided to try the effect of spraying the animals in groups. The animals were roped in so that each group was confined to one area of the yard, and two bucket pumps were used. It was soon found that once the animals were liberally sprayed on the face and along the backs they stood quite quietly and it was then possible to move in amongst them and spray thoroughly the less accessible parts, i.e., the brisket, belly, between the legs and under the tail. The animals were kept moving round as they were sprayed and if one attempted to move out of the roped area it was easily controlled by directing the spray jet on the front of its face. Bucket pumps proved fairly satisfactory for this method, but the buckets were liable to be tipped over in the deep straw often present in these fattening yards. In the later trials we used a Dorman Simplex wheelbarrow sprayer. This is a small spraying unit powered by a 1 h.p. J.A.P. engine and mounted on a small handcart. When fitted with two spray lances on long lengths of hose, it proved a very satisfactory apparatus for the work. The pump and container could be left outside the yard because of the long lengths of hose and therefore there was no danger of the container being knocked over and it could be replenished very readily.

This method of mass spraying was not wasteful of insecticide and by this means two operators, working one from either end, could spray effectively a group of 15 to 20 animals in about 10 minutes. If the insecticide was applied carefully the animals could be wetted as thoroughly as if each had been individually treated, and with far less labour. Handling of the animals themselves, apart from the examination of individual animals for diagnostic purposes, was unnecessary. The amount of insecticidal wash used with this method was approximately 1½ gallons per animal.

Summary

1. The treatment of three herds of 70 to 75 Lincoln Red steers affected with sarcoptic mange is described.

2. The insecticide was applied in the form of a spray and mass spraying of groups of 15 to 20 animals proved effective and labour-saving.

3. Two treatments at ten-day intervals with suspensions containing 0·25 per cent. B.H.C. are recommended to ensure the complete cure.

QUESTIONS AND ANSWERS

The submission of questions for inclusion in this column will be welcomed; they can relate to any aspect of veterinary work. For purposes of record, each question is numbered, and those submitting questions are required to furnish (not for publication) name and address.

Answers to readers' queries represent exclusively the personal opinions of the writers, and criticism of the replies will be appreciated.

All communications should be addressed to the Editor.

Treatment of Multiple Warts (Horse)

Q. 327.—*What is the best treatment for multiple warty growths on a horse? Are they likely to recur following surgical removal and if so, is there any preventative of such recurrence?*

A.—The treatment of multiple warty growths on the surface of the skin of the horse is very unsatisfactory and disappointing. Surgical removal helps to keep the animal useful for a varying period of time but as the condition is usually recurrent the outlook is not hopeful. The smaller warts may be snipped off with scissors and the larger ones may be removed with the wire écraseur or the elastic ligature. The scalpel may be employed when the wart is flat and has no neck and a portion of skin may have to be removed. Ascott's Spoon Forceps (Arnold & Sons) are recommended for the removal of "every kind of wart excrescence" and their use certainly limits haemorrhage. In the case of small fibromata, lying under the skin, the skin must be incised and the mass squeezed out or dissected out. Only a reasonable number of warts should be removed at one time and in many cases it is found necessary to cast and anaesthetise the animal. The administration of tetanus antitoxin should be carried out as a routine, as there is every danger of the disease following the operation. Of course, hot weather should be avoided on account of flies.

Caustics and, in some cases, the actual cautery are applied to the wound after removal of the wart with a view to preventing its recurrence and stopping haemorrhage. R. H. Smythe (Wooldridge's Encyclopaedia, page 1476), discussing warty growths on the surface of the sheath states: "Recurrence is, however, the rule, and it is advisable to dress the parts daily with sulphur iodide rubbed down with lard, removing the scab which forms every day before applying the ointment." Areas of small warty growths may be washed clean with soap and water and dressed daily with powdered alum and iodoform in a base of zinc ointment. The questioner may find interest in the answer given in *The Veterinary Record* of May 21st, 1949, and the letter by J. F. D. Tutt in the issue of July 2nd, 1949, under the heading "Angleberries in Cattle."

As recurrence is the rule rather than the exception, it is often advisable to consider slaughter for food purposes, except in the most valuable animals.

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Assessment of "Recently Calved"

Q. 328.—*If an animal is alleged to be recently calved when sold in an auction and on examination two days later the uterus and cervix appear to be completely involuted, on what may a definite opinion be based?*

A.—The rate of involution of the uterus and cervix after calving varies very much, depending on age and general health of the cow, size of the calf, whether full-term, simple unassisted calving or presence and degree of dystokia. In the writer's experience, involution *may* in exceptional cases be

References

1 Downing, W. (1947.) *Vet. Rec.* **59.** 581.

2 Heilsen, B. (1946.) "Studies on Acarus Scabiei and Scabies." Copenhagen: Rosenkilde and Bagger.

3 Gordon, Unsworth & Seaton. (1943.) *Ann. Trop. med. Parasit.* **37** (3-4). 175-194.

complete in a fortnight. More usually the process requires from four to eight weeks. The questioner would therefore be in order in expressing a *definite* opinion, in the case cited, that the cow had calved *at least* a fortnight, with a very strong probability that she had calved at least a month.

The only other feature which would assist in the formation of an opinion sufficiently definite to support in the witness-box would be the presence of a cyclic corpus luteum in the ovary, showing that ovulation had recommenced; this rarely occurs less than a month after calving, and, taken in conjunction with the degree of involution, might well be conclusive.

. . . . .

Treatment of Ear Canker Due to Pseudomonas pyocyanea

Q. 329.—*Swabs from a very obstinate case of ear canker in a Labrador have revealed the presence of* Pseudomonas pyocyanea. *Previous experiences of treatment of this condition have proved very disappointing. Can you suggest any reliable line of treatment?*

A.—Obstinate ear canker in a dog is likely to be grossly contaminated with many bacteria, and it is difficult to believe that swabs from such a case would reveal only a pure culture of *Pseudomonas pyocyanea*. The interpretation of bacteriological results from such a site would be extremely difficult, and it would be impossible to decide which organisms, if any, were primarily responsible for the inflammation. Certainly, in pyogenic wound infections of man, there may be a succession of predominating organisms including micrococci, staphylococci, streptococci, *Ps. pyocyanea* and *Proteus vulgaris*.

Nevertheless, *Ps. pyocyanea* has been recorded as causing infections in animals and birds, including large-scale outbreaks of disease in turkey poults. This organism is Gram-negative and it is unlikely to yield to treatment with penicillin, but sulphamerazine[1] and sulphamethazine have been found useful in the treatment of infections with Gram-negative bacteria. There is also laboratory evidence that infections of the eye with *Pseudomonas pyocyanea* can be cleared by treatment with soluble sodium sulphapyridine[2]. It is suggested that topical applications of one of the above drugs, which could be combined with penicillin for any Gram-positive organisms present, might clear the external ear of gross infection.

References

[1] Jones, J. C., & Anderson, G. W. (1948.) *J. Amer. vet. Med. Ass.* **113.** 450.

[2] Joy. H. H. (1940.) *Proc. Soc. exp. Biol. Med.* **45.** 709.

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Correspondence

A "Cardiac" Case for Diagnosis

Sir,—I should appreciate the expression of views as to diagnosis and comment on the following case:—

Subject.—Seven-year-old hunter mare. On trial for purchase.

History.—After a fairly hard day hunting, pulled up a mile or so from home and refused to move. Respiration somewhat laboured, some fresh sweating. After about an hour, was able to walk home slowly with difficulty. Placed in loose box, and commenced to eat hay. Almost immediately, she staggered, put her head low down in the far corner of the box, with fore legs partially flexed, and with violent trembling or twitching of the fore quarters. She went down, thrashed about with her legs, and passed into coma. She became conscious again fairly quickly and remained lying quiet for half an hour, after which she got up and commenced to feed.

Symptoms.—I saw her about half an hour later, when she looked normal, except for sweating and abrasions. Respiration about normal, temperature 100°, pulse 70, thready. Auscultation of the heart showed normal valvular sounds but complete arythmia, with a variation of from six to 20 very small thready beats, followed by one to three abnormally large ones, succeeded by more small beats.

Treatment.—None adopted. Decided to return the animal as soon as possible.

In view of the fact that the case could not be followed up, I should like your readers' views, particularly as to whether the trouble would be connected with the Vagus supply from the brain or originated from some nervous defect in the heart itself.

Yours faithfully,

Newton Square, L. W. Fuller.
Bampton,
Devon.

October 5th, 1949.

. . . . .

Technique for "Heart Beat Without Respiration" in the New-born

Sir,—In addition to your correspondent's advice I have found good results by grasping the tip of the tongue with a pair of forceps and drawing it out and in by steady regular strokes.

Yours faithfully,

Fryern Hall, Bridgwater. W. M. Scott.

SEX HORMONE THERAPY IN ANIMALS

The use of sex hormones in treating livestock for reproductive troubles is still beset with hazards and difficulties.

There are six reasons why widespread use of hormone products in veterinary medicine is not yet practical.

1. Most of the scientific research has been done with experimental animals, "mainly with white rats."

2. In treating various species of animals, the heredity, environment and many other factors must be considered.

3. Hormones are safely useful only in "selected cases" and "as an aid to other treatment and management practices."

4. The multiplicity of scientific names and trade names for hormones and hormone products is a cause of confusion.

5. The cost of such products often makes it economically impractical to use them.

6. Size and spacing of doses are still experimental problems.

G. H. Hart, D.V.M., M.D. (*Vet. Med.*).

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THE INSTITUTE OF MEAT

Addressing the recent annual conference of the National Federation of Meat Traders, Mr. Thomas Baker, President of the Institute of Meat, dealt with its activities, stating that the main task of the Institute continued to be the advancement of technical education for the meat industry.

One of the foremost aims of the Institute was to raise the status of the industry to professional level, and to do this it was essential to have an examination that was regarded by the Ministry of Education as up to the standards of other national examinations. There had been a good entry for the Ordinary Certificate, and for those aspiring to the very highest positions in the Industry the Council were preparing a Higher Certificate examination: an announcement about this should be made fairly soon.

The Institute had been represented on various other educational bodies, including the Food Advisory Committees, the Veterinary Organisations and the Royal Sanitary Institute. It had also been instrumental in maintaining a steady flow of information on technical educational subjects from the Continent by its continued membership of the International Confederation of Meat and Technical Associations.

Like the Federation, the Institute has been invited to submit a Memorandum of Evidence to the Interdepartmental Committee on Meat Inspection, regarding the qualifications and training facilities for Meat Inspectors.

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Weekly Wisdom

"Greater social security, improved standards of living, more leisure, better education, can all fit into a pattern for a happier society. But the plans depend for their fulfilment on personal morality rather than material conditions. Their mainspring is the quality of the individual and his sense of duty to the whole community."—Anon.

ABSTRACTS

[Disturbances in Rumen Digestion as a Predisposing Factor to the Appearance of Acetonaemia. Hoflund, S., & Hedstrom, H. (1948.) *Cornell Vet.* **38.** 405 417.]

These two authors have come to the conclusion that disturbances in rumen digestion are a predisposing factor in acetonaemia. They emphasise [very rightly] that acetonaemia in cattle is not a disease entity but is rather a symptom common to several diseases. Accordingly they classify acetonaemia according to its aetiology. Primary acetonaemia occurs as a result of either underfeeding or overfeeding. Secondary acetonaemia appears especially at calving or when a cow ceases to eat because of some disease.

Overfeeding acetonaemia has become more common, while underfeeding acetonaemia has decreased in Sweden due to rational farming and animal husbandry.

The authors calculate that a cow giving 30 litres of milk a day parts with 1,500 grammes of sugar, 1,200 grammes of butterfat and rather large quantities of vitamin B. Such a large amount of sugar cannot be supplied as such in the feed without causing digestive disturbance. The main part of the sugar must be produced in the rumen through cellulose fermentation. Accordingly, one of the principal factors in the prevention of acetonaemia is that the cellulose-fermenting organisms in the rumen have optimal conditions. As vitamin B is necessary for normal carbohydrate metabolism a high production of this material in the rumen is essential. This occurs when the number of fungi in the rumen is normal. For high milk production a ration with a high protein content is required. If the active rumen flora is not well adapted to this ration, abnormal, often toxic, protein compounds may be formed in the rumen and be absorbed. The already taxed liver must collect and detoxify these and in doing so the liver may be injured and metabolic disturbances follow its decrease in function.

When the change from a cellulose-rich ration for the dry cow to a protein-rich ration for the high-milk-yielding cow is made suddenly the fungi of the rumen are not able to increase themselves quickly. As the fungi use oxygen in the rapid fermentation of sugar and simultaneously produce carbon dioxide they make the medium suitable for the cellulose-fermenting bacteria. If for any reason the fungi decrease, cellulose-fermenting is impaired. So the increased sugar requirements of lactation cannot be supplied in the usual manner. Fat must be utilised and the liver is subjected to an additional tax in changing fat into sugar which occurs with the production of acetone bodies, the increased concentration of acetone bodies being demonstrable in the blood and urine. Furthermore, a decrease in the fungi entails a decrease in the production of vitamin B with consequent effects on carbohydrate utilisation.

The authors therefore argue that in order to produce optimal cellulose-fermenting conditions in the rumen the cow must continue to receive an adequate supply of readily available carbohydrate. In support of this argument they quote their experience of the value in preventing acetonaemia of feeding molasses during the period the cow is being brought on for lactation by changing over to a protein-rich diet. By feeding molasses during this transition period the cow is prevented from utilising her body fat for sugar production with the associated excessive acetone body production.

G. F. B.

[A Physiological Approach to the Problem of Ketosis. I. Basic Features of the Metabolic Processes Concerned in Ketosis. Dye, J. A., & McCandless, E. L. (1948.) *Cornell Vet.* **38.** 331 340.]

The authors quote work which they interpret as demonstrating convincingly that the liver is the chief if not the only source of acetoacetic acid from which beta-hydroxybutyric acid and acetone are formed. These ketone bodies are readily oxidised by the extra-hepatic tissues, especially the muscles and kidneys. Ketosis is a quantitative not a qualitative variation of this normal process.

Attention is drawn to three clinical conditions in the domesticated animals characterised by ketonaemia and ketonuria, namely, acetonaemia in cattle, pregnancy disease of sheep and diabetes in dogs. The ruminant appears to be prone to develop ketosis, especially during the increased metabolic activity concurrent with gestation and lactation. The factors that usually precipitate ketosis in sheep are said to be poor diet or poor appetite leading to undernutrition. The development of ketosis in cattle also takes place during gestation or lactation, although in this species the majority of cases are reported in the latter period. The pregnant cow is normally metabolising large amounts of fat and ketonuria is present in many pregnant cattle though relatively few exhibit symptoms of acetonaemia. The livers of pregnant cattle are usually heavily infiltrated with fat. When sources of blood glucose are deficient in the animal body and a hypoglycaemia tends to develop, fat and protein metabolism are both stepped up. The increase in fat oxidation is associated with an increased production and utilisation of ketone bodies, while the mobilisation of protein and fats leads to an increased conversion of these to glucose within the liver. The severity of ketosis is determined primarily by the level of fat metabolism and is inversely proportional to the level of carbohydrate metabolism. One of the outstanding differences between the carnivora and the ruminant is the fate of ingested carbohydrates which in ruminants have been shown to be converted, in large part, to the volatile lower fatty acids through the action of bacteria in the rumen. Glucose, fructose and sucrose are rapidly fermented to lactic acid in the rumen. Lactic acid is in part converted into the lower fatty acids and in part absorbed and oxidised by the tissues or converted into liver glycogen. Cellulose is made available to the ruminant for energy purposes through the action of the bacteria present in the rumen; these convert it to volatile fatty acids. The normal blood glucose level of the adult bovine lies between 40 and 60 mg. per 100 ml. This relatively low blood level appears to be due to two factors, (1) the relatively small portion of the dietary carbohydrate that escapes conversion to the lower fatty acids and (2) the relatively low level of gluconeogenesis in the liver. Under conditions of stress the balance between glucose supply to the blood and tissues and glucose utilisation is upset, producing a hypoglycaemia. The animal reacts by endeavouring to maintain its blood sugar level from mobilised protein and fat with excess production of ketones. The intravenous administration of carbohydrate in the form of glucose alleviates the hypoglycaemia and so supplants the need for the high fat metabolism with its concomitant ketone production. Unfortunately, the effect of the intravenous administration of carbohydrate is only temporary and would require to be repeated or maintained until the animal has adjusted its metabolism to meet the new demands. The authors suggest, therefore, that the continuous intravenous drip method might be the most useful way of administering glucose in the treatment of acetonaemia. The oral administration of molasses or glucose in the treatment of acetonaemia is condemned on the grounds that a very large part of the

ingested carbohydrate is converted to the lower fatty acids before absorption from the rumen and that these are largely changed into ketone bodies, aggravating rather than benefiting an existing ketosis.

G. F. B.

[*Abstractor's Note.*—These two papers agree in regard to the part played in the liver in the complex mechanism of sugar metabolism. They express, however, a completely different view of the nature and mechanism of digestion in the rumen. In consequence, though agreeing in regard to the value of carbohydrate intravenously in the treatment of ketosis, they are in complete disagreement as to the value of glucose given by mouth in the treatment of ketosis.]

NOTES AND NEWS

Diary of Events

Oct. 31st.—Commencement (in London) of R.C.V.S. Animal Management Examination.

Nov. 2nd.—Meeting of the Royal Microscopical Society (Biological Section) at B.M.A. House, Tavistock Square, W.C.1. 6 p.m.

Nov. 4th.—R.C.V.S. Pharmacology Examination (written).

Nov. 4th.—Meeting of the Yorkshire Division, Hotel Metropole, Leeds, at 2.30 p.m.

Nov. 5th.—Annual General Meeting of the Society of Women Veterinary Surgeons, at the Royal Veterinary College, Camden Town, N.W.1, 2 p.m.

Nov. 7th.—R.C.V.S. Pharmacology Examination (oral and practical), London and Dublin.

Nov. 7th.—Meeting of the Farmers' Club, Royal Empire Society, 2.30 p.m.

Nov. 9th.—Meeting of the N.V.M.A. Technical Development Committee, 11 a.m.

Nov. 9th.—Meeting of the Editorial Executive Committee, 2.30 p.m.

Nov. 11th.—R.V.C. Students' Union Society Commemoration Ball. (See Notice.)

Nov. 12th.—Dinner of the Southern Counties Division, N.V.M.A., at Southampton (Polygon Hotel), 7.30 p.m.

N.V.M.A. Committee and Council Meetings

The following are the arrangements for meetings of Committees and Council of the Association to be held in London in November:—

Tuesday, November 15th:

11 a.m.—Parliamentary and Public Relations Committee.
2 p.m.—Organising Committee.
4.15 p.m.—Home Appointments Committee.

Wednesday, November 16th:

10 a.m.—Veterinary State Medicine Committee.
2 p.m.—General Purposes and Finance Committee.

Thursday, November 17th:

11 a.m.—**Meeting of Council.**

Friday, November 18th:

10.30 a.m.—**Special Meeting of Council.**

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PERSONAL

Appointments.—The appointment in the Colonial Veterinary Service is announced of Mr. H. M. Stuchbery, Senior Veterinary Officer, Tanganyika, as Deputy Director of Veterinary Services, Nyasaland.

Major Hamilton Kirk, M.R.C.V.S., who leaves Clapton Greyhound Stadium at the end of this year, following his resignation after 21 years' service, has been appointed by London Stadiums, Ltd., as Chief Veterinary Surgeon to their group of tracks at Wandsworth, Park Royal and Charlton.

. . . . .

Birth.—Melrose.—On October 9th, 1949, at Reading, to Charlotte (Betty), wife of D. R. Melrose, B.SC., M.R.C.V.S., a son.

CONGRESS OF ANIMAL HUSBANDRY

The fifth International Congress of Animal Husbandry is being held in Paris from November 3rd to 10th. The Congress is being organised by the Association Française de Zootechnie and is sponsored by the French Ministry of Agriculture and F.A.O. Professor André M. Leroy is the Secretary-General.

There will be four main sections. In each section the principal papers will be given by invited persons. For Great Britain these are: Professor S. J. Watson, Edinburgh University; Dr. J. Hammond, School of Agriculture, Cambridge; Mr. J. Edwards, Milk Marketing Board, Thames Ditton, and Mr. J. P. Maule, Commonwealth Bureau of Animal Breeding and Genetics, Edinburgh.

Further information can be obtained from Mr. J. P. Maule, Commonwealth Bureau of Animal Breeding and Genetics, King's Buildings, West Mains Road, Edinburgh, 9.

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ROYAL VETERINARY COLLEGE AND HOSPITAL

It is announced that Lt.-Colonel Sir Archibald Weigall, BT., K.C.M.G., has relinquished the chairmanship of the Executive Council of the Royal Veterinary College and Hospital.

His successor is Professor C. A. Lovatt Evans, LL.D., D.SC., F.R.C.P., F.R.S., who until recently was Jodrell Professor of Physiology, University College, London.

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NEW FOREST AS AN ATTESTED AREA

Mr. Gould's Advice to Commoners

Mr. George Gould, M.R.C.V.S., Past-President and present Hon. Secretary of the N.V.M.A., who is veterinary surgeon to the New Forest Commoners' Defence Association, spoke to Association members at Brockenhurst about steps towards getting the forest to become a tuberculin tested area for cattle, and urged commoners to take an active interest towards this end.

Mr. Gould (says the *Western Gazette*) mentioned that he had suggested to the Association's Committee that the Verderers should be approached with a view to their giving notice to the commoners that, after a period of, say, three to five years, no one would be permitted to turn stock out on the forest unless the animals had been attested.

New Forest, the speaker continued, was particularly fortunate in having a very low tuberculosis incidence among cattle grazing there. The Ministry had confirmed that it was under 10 per cent. The incidence in commercial herds of the country varied enormously. In the average commercial herd outside the forest it would be somewhere about 40 per cent. He had known even 80 or 90 per cent. reactors. "The reason you have a low incidence here is that cattle are on an open range," said Mr. Gould.

The forest has led in vaccination against contagious abortion and it should lead in the eradication of tuberculous cattle.

Major Colin Ziegler, Association Chairman, said members could rest assured that the Committee would consider the subject very thoroughly. It would, no doubt, also be discussed at the local meetings which the Association arranged in various parts of the forest during the autumn, and a resolution might come up at the annual meeting.

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USE OF PRIVATE HOUSE FOR PROFESSIONAL PURPOSES

Ministry Upholds Appeal Against Refusal

A veterinary surgeon is free to use his private house for the purpose of treating sick animals without seeking permission from his local Council, the Ministry of Town and Country Planning has told Middlesex County Council.

Explaining in a letter why a veterinary surgeon's appeal against a decision not to allow him to use his home for professional purposes had been upheld, the Ministry stated:—

"The Minister has come to the conclusion that the use of two rooms as waiting room and consulting room in connection with the applicant's profession as a veterinary surgeon would be ancillary to the main use of the building as a dwelling, and that in these circumstances there would not be a material change of use.

"It follows that the use of the premises in the manner proposed would not constitute development within the meaning of the Act, and that planning permission is not required."

But the letter goes on to point out that in this particular application there was no question of boarding animals, whether under medical care or not, or of destroying animals. If any such use were proposed, it would be necessary to take this into consideration before making a ruling.

RABIES IN AN IMPORTED DOG

The value of the quarantine regulations in respect of imported dogs as a protection against widespread outbreaks of rabies and hydrophobia has again been demonstrated; a cross-bred terrier which was landed in Great Britain from the Gold Coast on October 10th died of rabies after being in quarantine for little more than 24 hours. It is reported that several persons had been bitten by the dog during the voyage to this country and that a dog on board the vessel was also attacked. Between the time of arrival at the quarantine kennels and its death, the dog bit a kennel attendant. All these persons have been exposed to the risk of hydrophobia.

This is the ninth occasion since the end of the war on which a dog has developed rabies whilst detained in quarantine kennels in this country. But for the regulations which require all imported dogs and cats to undergo six months' quarantine detention from the time of their arrival in Great Britain, any one of the affected animals might have been the cause of a series of outbreaks of rabies among British dogs, and had such outbreaks occurred, there would have been a grave risk to the human population of this country.

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FILMS OF VETERINARY INTEREST

"Liver Fluke in Great Britain" is the title of a new Central Office of Information film, made for the Ministry of Agriculture by Basic Films, Ltd. It was written and directed by John Shearman, and the technical advisers were Dr. E. L. Taylor, M.R.C.V.S., and Mr. S. B. Kendall, B.SC., M.R.C.V.S. Intended for a farming audience, the film outlines the long history of the discovery of the life cycle of the parasite, shows its various stages of development, and illustrates the natural habitat of the host snail and how the latter may be controlled by the use of copper sulphate. The photography and cinemicrography (by A. A. Englander, F.R.P.S.) are first class, and John Shearman has made a splendid job of bridging the gap between farmer and veterinary research laboratory.

"Liver Fluke in Great Britain" has a running time of 26 minutes. It will be distributed through the C.O.I. Mobile Units from mid-November onwards. 16 mm. copies will also be available, on free loan, from the Central Film Library, Imperial Institute, Kensington, S.W.7, for those organisations which have their own projectors.

The film "Sterility in Dairy Cattle," which was produced by Imperial Chemical Industries, Ltd., in association with the Animal Health Trust in 1946, gained first prize in the veterinary category at the recent International Film Festival in Venice. This film was directed by Mr. Frank Cadman, with the technical collaboration of Dr. W. R. Wooldridge and Professor C. W. Ottaway.

G. P. W.

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NATIONAL POULTRY SHOW

Schedules for the National Poultry Show at Olympia, London, on December 8th, 9th and 10th are being circulated this week to all previous exhibitors at this classic event.

Compared with last year's total of 181 there are, this year, 217 classes. For the first time the show will stage a number of Specialist Breed Club displays, among them the shows of the Buff Orpington, Rhode Island Red, Barnevelder and Welsummer Clubs.

Turkeys bid fair to make a big display at Olympia—both the White and Norfolk Black Clubs are supporting the event.

Entries are to close on November 7th or as soon as space available is filled. Intending exhibitors are advised to get their entries in as early as possible. Schedules are available from National Poultry Show, Dorset House, Stamford Street, London, S.E.1.

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DAIRY SHOW, OLYMPIA, 1949

Exhibit—Research in Animal Health and Dairying

The Ministry of Agriculture and the National Institute for Research in Dairying are co-operating in staging in the Empire Hall an exhibit portraying several aspects of recent research in the two fields of animal research and dairying.

The veterinary exhibits will illustrate some effects of mastitis on milk yields, the damage done by the warble fly, and how PPD tuberculin is prepared. PPD—the tuberculin with a guaranteed potency—is manufactured at the Veterinary Laboratory, Weybridge, and the exhibit will show the various stages in its preparation, including demonstrations of the bottling process.

The dairying research exhibit will feature the development of mechanical appliances as an aid to the craftsman in cheesemaking, and will demonstrate certain kinds of apparatus in practical use. Investigation into the variation of milking rates is continuing at the Institute, and the exhibit will illustrate some of the most recent results observed. The life of rubber parts of milking machines can be lengthened by chemical and steam sterilisation. How this can be done—and the effects of negligence—is shown in the exhibit. Demonstrations will be given in the use of the oestroscope—a simple piece of apparatus which determines whether a cow is on heat.

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Scheme for the Control of Diseases of Dairy Cattle

Statement showing the Number of Undertakings Notified to the Ministry of Agriculture during the Quarter Ended September 30th, 1949

County	Undertakings Notified		Total Undertakings	Number of Cattle	
	During Quarter	Previously		Cows	Heifers
England					
Bedford	—	2	2	28	18
Berks	—	22	22	6 5	462
Bucks	—	5	5	128	136
Cambridge	—	—	—	—	—
Cheshire	2	60	62	2,182	950
Cornwall	—	—	—	—	—
Cumberland	—	2	2	96	90
Derby	4	146	150	4,276	2,419
Devon	1	73	74	1,009	658
Dorset	—	2	2	41	16
Durham	3	83	86	2,382	1,118
Essex	3	66	69	3,061	2,299
Gloucester	1	15	16	519	547
Hampshire	7	58	65	2,442	2,355
Hereford	—	3	3	159	162
Hertford	1	21	22	690	432
Hunts	—	—	—	—	—
Isle of Ely	—	—	—	—	—
Isle of Wight	—	—	—	—	—
Kent	1	41	42	1,089	748
Lancs	4	29	33	1,378	483
Leics	4	48	52	1,425	1,215
Lincs (Holland)	—	—	—	—	—
Lincs (Kesteven)	2	8	10	130	156
Lincs (Lindsey)	2	—	2	65	54
Middlesex	—	2	2	32	10
Norfolk	1	21	22	948	634
Northants	—	14	14	286	493
Northumberland	—	22	22	577	556
Notts	2	82	84	1,889	855
Oxford	—	2	2	22	33
Rutland	—	—	—	—	—
Salop	—	36	36	7,040	775
Soke of Peterborough	—	—	—	—	—
Somerset	6	55	61	1,685	1,048
Staffs	2	72	74	2,3 9	1,525
Suffolk (East)	4	1	5	62	100
Suffolk (West)	1	16	17	450	369
Surrey	2	21	23	797	5 3
Sussex (East)	—	30	30	910	649
Sussex (West)	1	25	26	696	495
Warwick	6	38	44	1,326	653
Westmorland	1	2	3	47	23
Wilts	—	11	11	249	133
Worcester	2	62	64	1,310	754
Yorks (E.R.)	2	25	27	447	388
Yorks (N.R.)	3	37	40	843	486
Yorks (W.R.)	3	60	63	1,701	693
Total, England	71	1,318	1,389	45,330	25,4 3
Wales					
Anglesey	—	10	10	153	106
Brecon	—	—	—	—	—
Caernarvon	—	14	14	231	98
Cardigan	1	22	23	535	315
Carmarthen	1	68	69	1,361	806
Denbigh	—	8	8	170	65
Flint	—	20	20	486	187
Glamorgan	1	23	24	397	213
Merioneth	—	—	—	—	—
Monmouth	—	7	7	153	102
Montgomery	—	5	5	55	18
Pembroke	—	7	7	208	229
Radnor	—	1	1	5	1
Total, Wales	3	185	188	3,754	2,140
Total, England and Wales	74	1,503	1,577	49,084	27,543

Notes.—(1) Operative periods of undertakings: 1 year, 419; 2 years, 88; 3 years, 1,070. (2) Undertakings renewed for further periods: 1 year, 34; 2 years, 2; 3 years 21. (3) Undertakings not renewed at end of, or cancelled during, operative periods: 187. (4) The figures showing the number of undertakings notified during the quarter relate to entirely fresh undertakings and do not include undertakings renewed for further periods. Undertakings which have been cancelled or not renewed are not included in the figures for previous notifications.

County	Undertakings Notified		Total Undertakings in Force		
	During Quarter ending 30.9.49	Previously	Number	Number of Cattle	
				Cows	Heifers
SCOTLAND					
Aberdeen	—	12	12	619	381
Angus	—	9	9	564	327
Argyll	—	—	—	—	—
Ayr	—	3	3	104	77
Banff	—	—	—	—	—
Berwick	—	1	1	22	7
Bute	—	—	—	—	—
Caithness	—	—	—	—	—
Clackmannan	—	—	—	—	—
Dumfries	—	2	2	95	70
Dunbarton	—	1	1	12	10
East Lothian ..	—	—	—	—	—
Fife	—	19	19	676	502
Inverness	—	1	1	52	35
Kincardine	—	1	1	25	3
Kinross	—	3	3	81	62
Kirkcudbright	—	3	3	584	642
Lanark	—	1	1	36	22
Midlothian	—	—	—	—	—
Moray	—	—	—	—	—
Nairn	—	—	—	—	—
Orkney	—	—	—	—	—
Peebles	—	—	—	—	—
Perth	—	6	6	136	122
Renfrew	—	1	1	31	34
Ross-shire	—	2	2	126	36
Roxburgh	—	—	—	—	—
Selkirk	—	—	—	—	—
Stirling	—	3	3	137	140
Sutherland	—	2	2	39	34
West Lothian	—	1	1	17	29
Wigtown	—	3	3	305	149
Zetland	—	—	—	—	—
TOTAL	—	74	74	3,661	2,682

Notes.—(1) Duration of undertakings: 1 year, 24; 2 years, Nil; 3 years, 50. (2) Undertakings renewed for a further period: 1 year, 3; 2 years, Nil; 3 years, 2. (Included in the second column of the statement). (3) Undertakings expired and not renewed: 5 (Not included in the second column of the statement).

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MEAT INSPECTION

The Federation of Wholesale Fresh Meat Traders has appointed a special sub-committee to consider the terms of reference of the Interdepartmental Committee on Meat Inspection.

The sub-committee agrees that meat inspection should be standardised; inspection of meat should take place within three hours of slaughter; the regulations governing meat should take the onus from the owner on to the meat inspector, so that no prosecution can take place unless it can be proved that the owner is trying to avoid inspection.

The sub-committee consider that the actual inspection of meat should be carried out by men or women who have been specially trained and that they should, as far as possible, be recruited from the trade. Such persons should receive special instruction by qualified meat inspectors during their apprenticeship, in either the retail or wholesale part of the trade, and then pass on as meat inspectors' assistants, possibly as junior detention officers. It is suggested the country should be regionalised and that each district should be supervised by a veterinary surgeon who has had special courses in meat inspection and carried out the inspection of carcases.

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WORLD MEDICAL ASSOCIATION

Concerning the World Medical Association, to which reference was made in our issue of October 15th, *The Lancet* printed the following annotation in its corresponding number:—

This association has been holding its third annual assembly in London this week, at B.M.A. House. On British initiative it was founded, after the war, to promote closer ties among national medical associations and the doctors of the world, and membership is open to such associations. Forty-two countries now belong—the national associations of two of them being admitted last Tuesday—and 29 of the members have sent delegates to the present assembly. There are no delegates from Bulgaria, Hungary and Poland, and the president of the Chinese Medical Association, Dr. John Yui, has been unable to attend. At the opening of the assembly, the retiring president, Professor Eugène Marquis (France), spoke of the strength of the organisation, and referred to the Code of Geneva—a modern version of the Hippocratic Oath drawn up and adopted at the last assembly—as "this code which we hope will bring to the same standard the medical ethics for all nations who favour the cult of liberty." This year's president is Dr. Charles Hill, secretary of the British Medical Association.

This inaugural meeting agreed that a further study should be made of the status of the medical profession, particularly in relation to medical man-power, membership of national associations, and the economic status of the medical practitioner, including his standard of living and how this compares with that of other professional persons. The assembly was also in favour of studies on pharmaceutical practices and on hospitals; investigations already undertaken include those on social security and allied subjects, and on post-graduate medical education and specialist training. A conference is to be called for the co-ordination of scientific medical organisations, provided enough are interested: Dr. T. C. Routley (Canada), as chairman of council, explained that the idea was that through the W.M.A. such organisations could express their views to governments. Dr. Routley also referred to the value of exchanging medical journals, not only for providing information, but also as an inspiration for future activities. . . . The assembly passed a hearty vote of thanks to the American Medical Association and the United States committee of the World Medical Association. This committee raises funds in the United States which have enabled the W.M.A. to meet its initial running costs, and it is an indication of the interest taken in the association by individual U.S. doctors that they subscribed 12,000 dollars during the first six months of this year, the rest coming from other sources.

Observers from a number of outside bodies have been attending the assembly. These include representatives from the World Health Organisation of the United Nations, to which, it is stated, the World Medical Association bears the same relation as does the B.M.A. to the Ministry of Health—or nearly the same.

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REINDEER OFFERED TO BRITAIN

Breeding Area Sought

The proposal to introduce reindeer into Britain has resulted in the formation of the Reindeer Council of the United Kingdom. The Chairman is Sir Frederick Whyte.

The Council, says *The Times*, is pledged to encourage experiments in reindeer breeding in suitable areas of the United Kingdom and overseas. Its immediate object is to take advantage of an offer of 25 breeding and draught reindeer from Scandinavia, which would be transported to Britain and cared for by trained herders for three years without cost to the country.

The organisation is at present awaiting the results of negotiations with the Secretary of State for Scotland for the use of an experimental area in Scotland. One site suggested is the island of South Rona, between Skye and the mainland, but certain objections have been raised. Once a decision is obtained the animals can be shipped to Britain from Sweden with little delay.

The founders of the Council include travellers, explorers and Arctic experts who are concerned to develop national and Commonwealth resources to the full at this critical time, an addition to the present inadequate supply of meat and hides being one of their aims.

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MECHANISATION OF AGRICULTURE

At a recent session of the Economic Commission for Asia and the Far East (ECAFE) held in Lapstone, Australia, several delegates from Asia strongly criticised the U.N. Food and Agriculture Organisation (FAO) reports commending mechanisation of agriculture.

The Philippine delegate expressed in no uncertain terms that impoverishment followed the importation of American agricultural machinery in the Philippine Islands. This statement may have particular significance as it applies to agricultural practices in all densely populated areas where farming on small holdings is the rule. Considering the matter in terms of food supplies the effort of all concerned is to provide adequate or plentiful nourishing human food. To understand and appreciate the interdependence of agriculture on livestock and *vice versa* requires the consideration of many basic and intrinsic factors of local or national concern, as the case may be. What may be practical for the great plains area of the United States or the Russian Steppes is not necessarily advantageous elsewhere. It is not altogether a matter of raising "two blades of grass where one has grown," but also to raise a better quality foodstuff mindful of the prime necessity to avoid violation of all elements of soil conservation and the return of fertility to the soil.

Perhaps American agriculture machinery manufacturing interests have been convincing salesmen, but all interests involved should develop a stable recommendation that will ensure the results under divergent conditions for which all are striving. Mechanisation of agriculture is not a panacea for agriculture's ills, either at home or abroad.—*Vet. Med.*

FOWL PEST OUTBREAK IN SOUTH SCOTLAND

For the first time since fowl pest became prevalent among Scottish poultry flocks the disease was notified (on October 20th) as having broken out in the South of Scotland. The outbreak, which occurred near Wigtown, involved 300 birds, all of which have been destroyed.

The number of birds involved in Scotland is now about 7,880 and the total amount of compensation payable is about £9,000. The total number of outbreaks in Scotland has now reached 98.

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U.S.A. ARTIFICIAL INSEMINATION STATISTICS

Figures compiled by the Bureau of Dairy Industry, USDA, show that there were 316,177 herds, consisting of 2,412,160 cows enrolled as at January 1st, 1949, in 1,263 artificial breeding associations in the United States. This is an increase compared with figures of a year earlier of approximately 40 per cent.

Wisconsin leads all states in the number of cows in artificial breeding associations with 420,966. New York, Pennsylvania, Iowa and Minnesota follow in numbers in the order given.

"This statistical information," observes *Veterinary Medicine*, "supports the prophecy of speakers and those who wrote about artificial insemination in dairy cattle ten years ago. At that time there were only six associations organised for this work. The growth has been tremendous. Ten years ago veterinarians were encouraged to participate in this work but the general lack of interest by practitioners at that time and since has resulted in the bulk of the work now being performed by technicians. It is another example of failing to recognise an opportunity to broaden the field of our professional service. Apparently we continue to procrastinate as evidenced by the appeal of C. S. Rhode, Professor of Dairy Production Extension of the University of Illinois, who spoke before the general assembly of the A.V.M.A. meeting in Detroit. Professor Rhode pointed out that the present large scale practice of artificial insemination has focused attention on the very serious problem of sterility in dairy cattle. 'Complete co-operation of veterinarians is needed to help solve this problem,' he said.

"The entire matter has progressed to a point where the practitioner finds much cattle sterility work done by the technician. We will have to take the responsibility for the situation and at the same time interest ourselves in this important work which is still in the growing stage."

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the N.V.M.A.

IRISH MEMBERS AND THE NATIONAL VETERINARY MEDICAL ASSOCIATION OF GREAT BRITAIN AND IRELAND

Sir,—In the report of the Council Meeting of the N.V.M.A. held during the recent Congress in London, there appears a statement by a responsible member of the profession in Great Britain (Supplement to *The Veterinary Record*, October 1st, 1949, page 111) to the effect that only a small percentage of Irish members of the profession were actual members of the National Veterinary Medical Association, whereas a very high percentage of the profession in the South-East of England were members of that body. Similar statements have been made on several occasions at the annual meetings held during recent Congresses. In view of these statements and in justice to the profession in this country it would appear to be in the interests of all concerned to reveal the actual figures in connection with this matter; figures which have not hitherto been made known.

According to the handbook of the Annual Congress of the N.V.M.A. for 1949, there are 243 members who have addresses within the jurisdiction of the Irish Veterinary Council or, in other words, are registered in the Veterinary Register of Ireland. This figure amounts to approximately 50 per cent. of the members on the Irish Register, and this percentage would be considerably higher if the calculation were based only on the numbers of members of the profession actually resident in this country, having regard to the fact that a considerable number of those on the Irish Veterinary Register are practising, not in this country, but in Great Britain or in the British Colonies or Dominions, while they, for the time being, continue to be registered in the Irish Register.

The corresponding percentage for Great Britain is, of course, considerably higher, being approximately 70 per cent. of those on the British Veterinary Register, after deducting from this Register the numbers of members who are also on the Irish Register. This percentage, relative to that for Ireland, could not be expected to be otherwise in view of the fact that a very large proportion of the profession in England reside in or in the neighbourhood of London, and are consequently in direct contact with the headquarters of the profession, thus enabling them to participate actively in its political and scientific affairs. Owing to the distance factor, travel and other difficulties, Irish members are placed in a very different position as compared with their British colleagues; even to attend a Congress in Great Britain involves a considerable sacrifice on the part of most Irish members, and much as many of them would like to attend the Annual Congress regularly and be active members of the Association, this is simply impossible for the great majority, most of whom are single-handed practitioners.

Perhaps someone will work out and reveal the corresponding percentages for Scotland and Wales as separate entities, as these figures would doubtless prove to be of considerable interest from a comparison point of view.

Yours faithfully,

J. D. WHITTY,
President,
Veterinary Medical Association of Ireland,
Dublin.

1, Newtown Villas,
Rathgar, Dublin.
October 20th, 1949.

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BRITISH DELEGATION TO ANIMAL HEALTH CONFERENCE IN AUSTRALIA

Sir,—The report "News from Overseas" (Australia), pp. 708-9, *The Veterinary Record*, October 22nd, 1949, dealing with the above, has appeared most opportunely to offer unsolicited evidence of the extent to which the invasion of our field by non-veterinarians has become accepted and even recognised by those in authority.

Even the most liberally minded of our members must agree that the programme as reported indicates that the delegation with advantage could have carried at least one veterinary surgeon, and it would be interesting to know how his claims could have been overlooked.

Personally I was surprised that such a report was published in our official professional journal without comment either explanatory or condemnatory.

Yours faithfully,

Aberdeen. JOHN C. GRANT.
October 22nd, 1949.

DISEASES OF ANIMALS ACTS, 1894 TO 1937, AND AGRICULTURE ACT, 1937 (PART IV).

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period	Anthrax	Foot-and-mouth	Fowl Pest	Parasitic Mange*	Sheep Scab	Swine Fever
Sept. 16th to 30th, 1949	16	—	42	—	—	—
Corresponding period in—						
1948	9	1	2	—	9	—
1947	11	—	101	—	7	3
1946	2	2	—	—	5	9
Jan. 1st to Sept. 30th, 1949	166	13	408	—	33	5
Corresponding period in—						
1948	79	2	249	1	48	23
1947	87	103	861	1	64	29
1946	69	33	—	7	66	326

NOTE.—The figures for the current year are approximate only.

* Excluding outbreaks in Army Horses.

Tuberculosis (Attested Herds) Schemes

The number of Attested Herds, *i.e.*, herds officially certified as free from Tuberculosis as at September 30th, 1949, was as follows:—

ENGLAND	WALES	SCOTLAND	TOTAL (GREAT BRITAIN)
17,240	13,552	11,969	42,761